PART L
CRANES, DERRICKS, HOISTS, ELEVATORS, AND CONVEYORS

WAC 296-155-525 Cranes and derricks.

(1) Definitions applicable to this part:

Accessory - a secondary part or assembly of parts which contributes to the overall function and usefulness of a machine.

Administrative or regulatory authority - a governmental agency, or the employer in the absence of governmental jurisdiction.

Angle indicator (boom) - an accessory which measures the angle of the boom to the horizontal.

Appointed - assigned specific responsibilities by the employer or the employer's representative.

Authorized person - means a person approved or assigned by the employer to perform a specific type of duty or duties or be at a specific location or locations at the workplace.

Auxiliary hoist - a secondary hoist rope system used either in conjunction with, or independently of, the main hoist system.

Axis of rotation - the vertical axis around which the crane superstructure rotates.

Axle - the shaft or spindle with which or about which a wheel rotates. On wheel-mounted cranes it refers to a type of axle assembly including housings, gearing, differential, bearings, and mounting appurtenances.

Axle (bogie) - two or more axles mounted in tandem in a frame so as to divide the load between the axles and permit vertical oscillation of the wheels.

Ballast - weight used to supplement the weight of the machine in providing stability for lifting working loads (the term **ballast** is normally associated with locomotive cranes).

Base, anchor bolt - a crane base that is bolted to a footing.

Base, expendable - for static-mounting cranes, a style of bottom mast section or member that is cast into a concrete footing block; all or part of this component is lost to future installations.

Base, fixed - a crane base that does not travel. It may be expendable, knee braced, or anchor bolted.

Base (mounting) - the traveling base on which the rotating superstructure of a locomotive or crawler crane is mounted.

Base, tower crane - the lowermost supporting component of the crane.

Base, travel - a crane base that is a ballasted platform mounted on trucks that ride along rails.

Boom (crane) - a member hinged at the rotating superstructure and used for supporting the existing tackle.

Boom angle - the angle above or below horizontal of the longitudinal axis of the base boom section.

Boom hoist mechanism - means for supporting the boom and controlling the boom angle.

WAC 296-155-525 (Cont.)

Boom point - the outer extremity of the crane boom, containing the hoist sheave assembly.

Boom point sheave assembly - an assembly of sheaves and pin built as an integral part of the boom point.

Boom stop - a device used to limit the angle of the boom at the highest recommended position.

Brake - a device used for retarding or stopping motion.

Brace, tower - a structural attachment placed between a crane tower and an adjacent structure to pass loads to the adjacent structure and permit the crane to be erected to greater than free standing height.

Buffer - an energy absorbing device for reducing impact when a moving crane or trolley reaches the end of its permitted travel.

Cab - a housing which covers the rotating superstructure machinery, or the operator's or driver's station.

Climbing frame - a frame used with climbing cranes to transmit operational and climbing reactions to the host building frame.

Climbing ladder - a steel member with crossbars (used in parts) suspended from a climbing frame and used as jacking support points when some cranes climb.

Clutch - a means for engagement or disengagement of power.

Commercial truck vehicle - a commercial motor vehicle designed primarily for the transportation of property in connection with business and industry.

Counterweight - weight used to supplement the weight of the machine in providing stability for lifting working loads.

Counterweight jib - a horizontal member of a crane on which the counterweights and usually the hoisting machinery are mounted.

Crane carrier - the undercarriage of a wheel-mounted crane specifically designed for transporting the rotating crane superstructure. It may or may not provide its own travel mechanism. It is distinguished from a commercial truck vehicle in that it is not designed to transport personnel, materials, or equipment other than the crane-rotating superstructure.

Cross-over points - in multiple layer spooling of rope on a drum, those points of rope contact where the rope crosses the preceding rope layer.

Designated - selected or assigned by the employer or the employer's representative as being competent to perform specific duties.

Drum - the cylindrical member around which a rope is wound for lifting and lowering the load or boom.

Dynamic (loading) - loads introduced into the machine or its components due to accelerating or decelerating forces.

Flange point - a point of contact between rope and drum flange where the rope changes layers.

Free standing height - that height of a crane which is supported by the tower (mast) alone without assistance from braces, guys, or other means.

WAC 296-155-525 (Cont.)

Gage, track - the horizontal distance between two rails measured perpendicular to the direction of travel.

Gantry (A-frame) - a structural frame, extending above the superstructure, to which the boom support ropes are reeved.

High strength (traction) bolts - high strength tensile bolts used in the assembly of crane sections. The bolts are installed in tension by torquing or other means at a level greater than that produced by in-or out-of-service loads for the purpose of reducing the likelihood of bolt fatigue failure.

Hoist mechanism - a hoist drum and rope reeving system used for lifting and lowering loads.

Jib - an extension attached to the boom point to provide added boom length for lifting specified loads. The jib may be in line with the boom or offset to various angles in the vertical plane of the boom.

Jib backstop - a device which will restrain the jib from turning over backward.

Job site - work area defined by the construction contract.

Limiting device - a mechanical device which is operated by some part of a power driven machine or equipment to control loads or motions of the machine or equipment.

Load (working) - the external load in pounds (kilograms) applied to the crane, including the weight of load-attaching equipment such as lower load block, shackles, and slings.

Load block, lower - the assembly of hook or shackle, swivel, sheaves, pins, and frame suspended by the hoisting ropes.

Load block, upper - the assembly of shackle, swivel, sheaves, pins, and frame suspended from the boom point.

Load ratings - crane ratings in pounds (kilograms) established by the manufacturer.

Mast (boom) - a frame hinged at or near the boom hinge for use in connection with supporting a boom. The head of the mast is usually supported and raised or lowered by the boom hoist ropes.

Mast (jib) - a frame hinged at or near the boom point for use in connection with supporting a jib.

Normal operating conditions.

Cab- or station-operated cranes - conditions during which a crane is performing functions within the manufacturer's operating recommendations. Under these conditions, the operator is at the operating control devices on the crane, and no other persons except those appointed are to be on the crane.

Ground- or floor-operated cranes - conditions during which a crane is performing functions within the manufacturer's operating recommendations. Under these conditions, the operator is at the operating control devices that are mounted to the crane but operated with the operator off the crane, and no other persons except those appointed are to be on the crane.

Remote-operated cranes - conditions during which a crane is performing functions within the manufacturer's operating recommendations. Under these conditions, the operator is at the operating control devices that are mounted to any part of the crane, and no other persons except those appointed are to be on the crane.

WAC 296-155-525 (Cont.)

Out-of-service - the condition of a crane when unloaded, without power and with the controls unattended and prepared to endure winds above the in-service level.

Outriggers - extendable or fixed members attached to the mounting base, which rest on supports at the outer ends used to support the crane.

Pawl (dog) - a device for positively holding a member against motion in one or more directions.

Payload - that load or loads being transported by the commercial truck chassis from place to place.

Pendant - a rope or strand of specified length with fixed end connections.

Pitch diameter - the diameter of a sheave or rope drum measured at the center line of the rope.

Power-controlled lowering - a system or device in the power train, other than the load hoist brake, which can control the lowering rate of speed of the load hoist mechanism.

Qualified person - a person who, by possession of a recognized degree or certificate of professional standing, or who, by extensive knowledge, training, and experience, has successfully demonstrated the ability to solve or resolve problems relating to the subject matter and work.

Radius (load) - the horizontal distance from a projection of the axis of rotation to the base of the crane, before loading, to the center of the vertical hoist line or tackle with load applied.

Rail clamp - a tong-like metal device mounted on a locomotive crane car, which can be connected to the track.

Reeving - a rope system in which the rope travels around drums and sheaves.

Remote control station - a location, not on the crane, from which the operator can control all the crane movements.

Repetitive pickup point - when operating on a short cycle operation, the rope being used on a single layer and being spooled repetitively over a short portion of the drum.

Rope - refers to wire rope unless otherwise specified.

Rotation resistant rope - a wire rope consisting of an inner layer of strand laid in one direction covered by a layer of strand laid in the opposite direction. This has the effect of counteracting torque by reducing the tendency of the finished rope to rotate.

Running rope - a rope which travels around sheaves or drums.

Shall - this word indicates that the rule is mandatory and must be followed.

Service, light - service that involves irregular operation with loads generally about one-half or less of the rated load; a service crane at a storage yard or building site would be an example.

Service, normal - service that involves operating occasionally at rated load but normally at less than eighty-five percent of the rated load and not more than ten lift cycles per hour except for isolated instances; a crane used for concrete placement at a building site would be an example.

WAC 296-155-525 (Cont.)

Service, heavy - service that involves operating at eighty-five percent to one hundred percent of the rated load or in excess of ten lift cycles per hour as a regular specified procedure; some cranes operating at material yards or in industrial applications may fall into this category.

Sheave - a grooved wheel or pulley used with a rope to change the direction and point of application of a pulling force.

Should - this word indicates that the rule is a recommendation, the advisability of which depends on the facts in each situation.

Side loading - a load applied to an angle to the vertical plane of the boom.

Stabilizer - stabilizers are extendable or fixed members attached to the mounting base to increase the stability of the crane, but which may not have the capability of relieving all of the weight from wheels or tracks.

Standby crane - a crane which is not in regular service but which is used occasionally or intermittently as required.

Standing (guy) rope - a supporting rope which maintains a constant distance between the points of attachment to the two components connected by the rope.

Structural competence - the ability of the machine and its components to withstand the stresses imposed by applied loads.

Superstructure - the rotating upper frame structure of the machine and the operating machinery mounted thereon.

Swing - rotation of the superstructure for movement of loads in a horizontal direction about the axis of rotation.

Swing mechanism - the machinery involved in providing rotation of the superstructure.

Swivel - a load carrying member with thrust bearings to permit rotation under load in a plane perpendicular to the direction of the load.

Swiveling - the rotation of the load attachment portion (hook or shackle) of a load block (lower) or hook assembly about its axis of suspension in relation to the load line(s).

Tackle - an assembly of ropes and sheaves arranged for lifting, lowering, or pulling.

Telescoping boom - consists of a base boom from which one or more boom sections are telescoped for additional length.

Telescoping (tower crane) - a process whereby the height of a traveling or fixed base crane is increased typically by raising the inner tower and then adding sections at the top of the outer tower; there are also cranes that are telescoped by adding to the inner tower from below.

Tower (mast) - a vertical structural frame consisting of columns and bracing capable of supporting an upperstructure with its working and dynamic loads and transmitting them to the supporting surface or structure.

Traction (high strength) bolts - see high strength bolts.

Transit - the moving or transporting of a crane from one job site to another.

Travel - the function of the machine moving under its own power from one location to another on a job site.

WAC 296-155-525 (Cont.)

Trolley - the device that travels along the load jib and contains the upper load block.

Two-blocking - the condition in which the lower load block or hook assembly comes in contact with the upper load block or boom point sheave assembly.

Weathervaning - wind induced rotation of a crane upperstructure, when out-of-service, to expose minimal surface area to the wind.

Wedge - a tapered wood or steel device used to provide stability to cranes during use as a climber. When the wedges are tightened against the four main legs of the tower, they convert overturning moments into horizontal forces to be resisted by the floor framing or slab.

Wheel base - the distance between centers of front and rear axles. For a multiple axle assembly the axle center for wheel base measurement is taken as the midpoint of the assembly.

Whipline (runner or auxiliary) - a secondary rope system usually of lighter load capacity than that provided by the main rope system.

Winch head - a power driven spool for handling of loads by means of friction between fiber or wire rope and the spool.

(2) General requirements.

(a) The employer shall comply with the manufacturer's specifications and limitations applicable to the operation of any and all cranes and derricks. Where manufacturer's specifications are not available the limitations assigned to the equipment shall be based on the determinations of a qualified engineer, competent in this field and such determinations will be appropriately documented and recorded. Attachments used with cranes shall not exceed the capacity, rating, or scope recommended by the manufacturer.

(b) Rated load capacities, and recommended operating speeds, and special hazard warnings, or instruction, shall be conspicuously posted on all equipment. Instructions or warnings shall be visible to the operator while at the control station.

(c) Hand signals to crane and derrick operators shall be those prescribed by the applicable ANSI standard for the type of crane in use. An illustration of the signals shall be posted at the job site.

(d) The employer shall designate a competent person who shall inspect all machinery and equipment prior to each use, and periodically during use to make sure it is in safe operating condition. Any deficiencies shall be repaired, or defective parts replaced, before continued use.

(e) A thorough, annual inspection of the hoisting machinery shall be made by a competent person, or by a government or private agency recognized by the department. The employer shall maintain a permanent record of the dates and results of all inspections for each hoisting machine and piece of equipment.

(f) A tag line or guide rope shall be used on all loads that swing freely. Guide ropes or tag lines shall be held by experienced persons.

(g) Care shall be taken to guard against injury to workers, or damage to scaffolds or buildings, from swinging loads.

WAC 296-155-525 (Cont.)

(h) The operator shall avoid carrying loads over people.

(i) When work is stopped or when the derrick is not in operation, the boom shall be lowered to a horizontal position or tied in place to prevent it whipping with the wind or other external force.

(j) Only authorized personnel shall make sling hitches on loads.

(k) Workers shall not be allowed to ride on loads handled by derricks.

(l) Operators shall observe signals only from duly authorized persons. Under no circumstances shall a load be moved until the signal is received from authorized personnel.

(m) Belts, gears, shafts, pulleys, sprockets, spindles, drums, fly wheels, chains, or other reciprocating, rotating, or other moving parts or equipment shall be guarded if such parts are exposed to contact by employees, or otherwise create a hazard. Guarding shall meet the requirements of chapter 296-806 WAC, Machine safety.

(n) A minimum distance of thirty inches clearance shall be maintained between the swing radius of the greatest extension of the crane superstructure or counterweights and a stationary object, including the crane itself, while the crane is in operation. When this clearance cannot be maintained, suitable barricades or safeguards shall be used to isolate the pinch point hazard area.

(o) All exhaust pipes shall be guarded or insulated where contact by employees, in the performance of normal duties, is possible.

(3) Additional requirements.

(a) Whenever internal combustion engine powered equipment exhausts in enclosed spaces, tests shall be made and recorded to see that employees are not exposed to unsafe concentrations of toxic gases or oxygen deficient atmospheres. (See chapter 296-62 WAC, the general occupational health standards and chapter 296-841 WAC, Identifying and controlling respiratory hazards.)

(b) All cab glazing shall be safety glazing material. Windows shall be provided in the front and on both sides of the cab or operator's compartment with visibility forward and to either side. Visibility forward shall include a vertical range adequate to cover the boom point at all times. The front window may have a section which can be readily removed or held open, if desired. If the section is of the type held in the open position, it shall be secured to prevent inadvertent closure. A windshield wiper should be provided on the front window.

(c) (i) Where necessary for rigging or service requirements, a ladder or steps shall be provided to give access to a cab roof.

(ii) On cranes, guardrails, handholds and steps shall be provided for easy access to the car and cab in accordance with chapter 296-155 WAC, Part C-1 and Part J.

(iii) Platforms and walkways shall have anti-skid surfaces.

(d) Fuel tank filler pipe shall be located in such a position, or protected in such manner, as to not allow spill or overflow to run onto the engine, exhaust, or electrical equipment of any machine being fueled.

WAC 296-155-525 (Cont.)

(i) An accessible fire extinguisher of 5BC rating, or higher, shall be available at all operator stations or cabs of equipment.

Note: For additional requirements relating to portable fire extinguishers see WAC 296-800-300.

(ii) All fuels shall be transported, stored, and handled to meet the rules of Part D of this chapter. When fuel is transported by vehicles on public highways, department of transportation rules concerning such vehicular transportation are considered applicable.

(e) Except where electrical distribution and transmission lines have been deenergized and visibly grounded at point of work or where insulating barriers, not a part of or an attachment to the equipment or machinery, have been erected to prevent physical contact with the lines, equipment or machines shall be operated proximate to power lines only in accordance with the following:

(i) For lines rated 50 kV. or below, minimum clearance between the lines and any part of the crane or load shall be 10 feet;

(ii) For lines rated over 50 kV., minimum clearance between the lines and any part of the crane or load shall be 10 feet plus 0.4 inch for each 1 kV. over 50 kV., or twice the length of the line insulator, but never less than 10 feet;

(iii) In transit with no load and boom lowered, the equipment clearance shall be a minimum of 4 feet for voltages less than 50 kV., and 10 feet for voltages over 50 kV. up to and including 345 kV., and 16 feet for voltages up to and including 750 kV;

(iv) A person shall be designated to observe clearance of the equipment and give timely warning to insure that the required separation is maintained for all operations where it is difficult for the operator to maintain the desired clearance by visual means;

(v) Cage-type boom guards, insulating links, or proximity warning devices may be used on cranes, but the use of such devices shall not alter the requirements of any other regulation of this part even if such device is required by law or regulation;

(vi) Any overhead wire shall be considered to be an energized line unless and until the person owning such line or the electrical utility authorities indicate that it is not an energized line and it has been visibly grounded;

(vii) Prior to work near transmitter tower where an electrical charge can be induced in the equipment or materials being handled, the transmitter shall be deenergized or tests shall be made to determine if electrical charge is induced on the crane.

(f) The following precautions shall be taken when necessary to dissipate induced voltage:

(i) The equipment shall be provided with an electrical ground directly to the upper rotating structure supporting the boom; and

(ii) Ground jumper cables shall be attached to materials being handled by boom equipment when electrical charge is induced while working near energized transmitters. Crews shall be provided with nonconductive poles having large alligator clips or other similar protection to attach the ground cable to the load.

(iii) Combustible and flammable materials shall be removed from the immediate area prior to operations.

WAC 296-155-525 (Cont.)

(g) No modifications or additions which affect the capacity or safe operation of the equipment shall be made by the employer without the manufacturer's or a qualified engineer's written approval. If such modifications or changes are made, the capacity, operation, and maintenance instruction plates, tags, or decals, shall be changed accordingly. In no case shall the original safety factor of the equipment be reduced.

(h) The employer shall comply with Power Crane and Shovel Association, Mobile Hydraulic Crane Standard No. 2.

(i) Sideboom cranes mounted on wheel or crawler tractors shall meet the requirements of SAE J743a-1964.

(4) Crawler, locomotive, and truck cranes.

(a) All jibs shall have positive stops to prevent their movement of more than 5° above the straight line of the jib and boom on conventional type crane booms. The use of cable type belly slings does not constitute compliance with this standard.

(b) All crawler, truck or locomotive cranes in use shall meet the applicable requirements for design, inspection, construction, testing, maintenance and operation as prescribed in the ANSI B30.5-1989, Safety Code for Crawler, Locomotive and Truck Cranes.

(5) Tower cranes.

(a) Tower cranes shall be erected, jumped and dismantled under the immediate supervision of a competent person, designated by the employer.

(b) Tower cranes shall be erected, maintained and used in accordance with the manufacturer's specifications, recommendations and procedures. All modifications shall be approved by the manufacturer and engineered by a professional engineer. The safety factors shall not be reduced by any modifications. The crane plates and charts shall be changed to reflect any modifications made.

(c) A professional engineer shall certify that the crane foundations and underlying soil are adequate support for the tower crane with its maximum overturning movement.

(d) Tower cranes shall be positioned whereby they can swing 360° without either the counterweight or jib striking any building, structure or other object, except:

(i) If the crane can strike an object or another crane, suitable limit switches shall be installed which will prohibit contact with such objects, or;

(ii) Direct voice communications shall be established between any operator of the tower crane(s) involved and a signalperson so stationed where the boom and/or counterweight movement, and the object with which it may contact can be observed so that the operator(s) can be warned of imminent danger.

(iii) A secondary means of positive communications shall be established as a back-up for possible direct voice communication failure.

(iv) Radio communication systems without tone coded squelch are prohibited. Citizens band radios shall not be used as a means of communications for tower cranes.

WAC 296-155-525 (Cont.)

(e) Prior to installing a climbing tower crane within an existing building or new construction, a structural engineer shall certify that the building is designed to withstand the torque and floor loading created by the crane to be installed.

(f) Tower cranes erected on a new foundation shall be tested in accordance with ANSI B30.3-1990 Chapter 3-1.

(i) The test shall consist of suspending a load of not less than 110% of the rated capacity for 15 minutes. The load shall be suspended from the furthest point of the length of boom (jib) to be used. The results of this test shall be within the manufacturer's recommendations and/or specifications.

(ii) A record of each test shall be made and signed by the person responsible for conducting the test. Such records shall be maintained on the construction site for the duration of the construction work for which it was erected and subsequently made a part of the firm's permanent equipment records. Records shall be made available to authorized representatives of the department, upon request.

(g) A capacity chart shall be furnished by each crane manufacturer which shall include a full and complete range of crane load ratings at all stated operating radii for each allowable speed and each recommended counterweight load.

(i) Such chart shall be posted in the operator's cab or at the remote control stand in use. In lieu of the chart at the remote control stand, a minimum of two weight capacity signs shall be affixed to the jib or boom.

(ii) The chart shall be visible and readable to the operator while at the normal operating position.

(h) Operating controls shall be properly marked to indicate the function of the controls in each position.

(i) An operating and maintenance manual written in the English language shall be provided with each tower crane.

(j) Limit switches shall be installed and shall be kept properly adjusted. They shall be protected or isolated in a manner which will prevent unauthorized tampering. Limit switches shall provide the following functions:

(i) Safely limit the travel of the trolley to prevent it from hitting the outer end of the jib.

(ii) Limit the upward travel of the load block to prevent two-blocking.

(iii) Lower over travel limiting devices shall be provided for all load hoists where the hook area is not visible to the operator.

(iv) Limit the load being lifted in a manner whereby no more than 110% of the maximum rated load can be lifted or moved.

(k) The crane shall not be used to pull vehicles of any type, remove piling, loosen form work, pull away loads which are attached to the ground or walls, or for any operation other than the proper handling of freely suspended loads.

WAC 296-155-525 (Cont.)

(l) When the operator may be exposed to the hazard of falling objects, the tower crane cab and/or remote control station shall have adequate overhead protection.

(m) The operator shall be protected from the weather. If enclosed cabs are provided they shall provide clear visibility in all directions and glass shall be approved safety glass or the equivalent.

(n) An approved and safe means shall be provided for access to operator's cab and machinery platform.

(o) When necessary for inspection or maintenance purposes, ladders, walkways with railing or other devices shall be provided.

(p) Each tower crane shall be provided with a slewing brake capable of preventing the jib or boom from rotating in either direction and stopping the rotation of the jib or boom while loaded, when desired. Such brake shall have a holding device which, when set, will hold the jib or boom in a fixed location without additional attention of the operator. When the crane is out of operation, the jib or boom shall be pointed downwind and the slewing brake shall be released so as to permit the jib or boom to weathervane, providing the jib or boom has a clear 360 degree rotation. Where a 360 degree rotation is not provided, the jib or boom shall be pointed downwind from the prevailing wind and the slewing brake set.

(q) Each tower crane shall be provided with a braking system on the trolley capable of stopping and holding the trolley in any desired position while carrying a maximum load. This brake shall be capable of being locked in a fixed location without additional attention of the operator. An automatic brake or device shall be installed which will immediately stop and lock the trolley in position in the event of a breakage of the trolley rope.

(r) All electrical equipment shall be properly grounded and protection shall be provided against lightning.

(s) When the operator is actually operating the crane, the operator shall remain in a stationary position.

(t) All crane brakes shall automatically set in event of power failure. Swing brakes shall also function in this manner or be capable of being set manually.

(u) Climbing jack systems used for raising a tower crane shall be equipped with over-pressure relief valves, direct-reading pressure gauges, and pilot-operated hydraulic check valves installed in a manner which will prevent jack from retracting should a hydraulic line or fitting rupture or fail.

(v) During periods of high winds or weather affecting visibility, i.e., fog, etc., only loads shall be handled that are consistent with good safety practices. Good safety practices shall be mutually agreed upon by the operator and the person in charge of the construction job, with due consideration given to manufacturer's specifications and recommendations.

(w) Counterweights shall be securely fastened in place and shall not exceed the weight as recommended by the manufacturer for the length of jib being used. However, an amount of counterweight as recommended by the manufacturer shall be used.

(x) Tower cranes shall be inspected and maintained in accordance with the manufacturer's recommendations or more frequently if there is reason to suspect a possible defect or weakening of any portion of the structure or equipment.

WAC 296-155-525 (Cont.)

(y) Guy wires, wedges, braces or other supports shall be inspected at the beginning and at midpoint of each working shift to ascertain that they are functioning as intended.

(6) Additional tower crane requirements.

(a) An approved method must be instituted for transmitting signals to the operator. Standard hand signals for crane operations must be used, whenever possible; however, if conditions are such that hand signals are ineffective, radio-controlled or electric-whistle signal or two-way voice communication must be used. (See WAC 296-155-525(5)(d).)

(b) Tower cranes shall not be erected or raised when the wind velocity at the worksite exceeds 20 m.p.h. or that specified by the manufacturer.

(c) Tower crane operators shall be trained and experienced in tower crane operations; however, for gaining experience, persons may operate the tower crane if under the immediate supervision of an experienced operator.

(d) Adequate clearance shall be maintained between moving and rotating structures of the crane and fixed objects to allow the passage of employees without harm.

(e) Employees required to perform duties on the horizontal boom of hammerhead tower cranes shall be protected against falling by guardrails or by a full body harness and lanyards attached to crane or to lifelines in conformance with Part C-1 of this chapter.

(f) Buffers shall be provided at both ends of travel of the trolley.

(g) Cranes mounted on rail tracks shall be equipped with limit switches limiting the travel of the crane on the track and stops or buffers at each end of the tracks.

(h) All hammerhead tower cranes in use shall meet the applicable requirements for design, construction, installation, testing, maintenance, inspection, and operation as prescribed by the manufacturer.

(i) Access ladders inside the telescoping sections of tower cranes are exempt from those sections of the safety standards pertaining to cleat length and cleat spacing, but shall conform to manufacturer's recommendations and specifications.

(7) Overhead and gantry cranes.

(a) The rated load of the crane shall be plainly marked on each side of the crane, and if the crane has more than one hoisting unit, each hoist shall have its rated load marked on it or its load block, and this marking shall be clearly legible from the ground or floor.

(b) Bridge trucks shall be equipped with sweeps which extend below the top of the rail and project in front of the truck wheels.

(c) Except for floor-operated cranes, a gong or other effective audible warning signal shall be provided for each crane equipped with a power traveling mechanism.

(d) All overhead and gantry cranes in use shall meet the applicable requirements for design, construction, installation, testing, maintenance, inspection, and operation as prescribed in ANSI B30.2.0-1990, Safety Code for Overhead and Gantry Cranes.

WAC 296-155-525 (Cont.)

(8) Derricks. All derricks in use shall meet the applicable requirements for design, construction, installation, inspection, testing, maintenance, and operation as prescribed in American National Standard Institute B30.6-1990, Safety Code for Derricks.

(9) Floating cranes and derricks.

(a) Mobile cranes mounted on barges.

(i) When a mobile crane is mounted on a barge, the rated load of the crane shall not exceed the original capacity specified by the manufacturer.

(ii) A load rating chart, with clearly legible letters and figures, shall be provided with each crane, and securely fixed at a location easily visible to the operator.

(iii) When load ratings are reduced to stay within the limits for list of the barge with a crane mounted on it, a new load rating chart shall be provided.

(iv) Mobile cranes on barges shall be positively secured.

(b) Permanently mounted floating cranes and derricks.

(i) When cranes and derricks are permanently installed on a barge, the capacity and limitations of use shall be based on competent design criteria.

(ii) A load rating chart with clearly legible letters and figures shall be provided and securely fixed at a location easily visible to the operator.

(iii) Floating cranes and floating derricks in use shall meet the applicable requirements for design, construction, installation, testing, maintenance, and operation as prescribed by the manufacturer.

(c) Protection of employees working on barges. The employer shall comply with the applicable requirements for protection of employees as specified in WAC 296-155-630.

(10) Mobile cranes and excavation machines.

(a) In all power driven shovel operations the person in charge shall issue instructions necessary to prevent accidents, to detect and correct unsafe acts and dangerous conditions, and to enforce all safety rules and regulations.

The person in charge shall also issue instructions on the proper method of using tools and handling material.

(b) Where the ground is soft or uneven, timbering and planking shall be used to provide firm foundation and distribute the load.

(c) In case of a breakdown, the shovel shall be moved away from the foot of the slope before repairs are made.

(d) All persons shall keep away from the range of the shovel's swing and shall not be permitted to stand back of the shovel or in line with the swing of the dipper during operation or moving of shovel.

WAC 296-155-525 (Cont.)

(e) Unauthorized persons shall not be allowed on the shovel during operations, and the operator shall not converse with other persons while operating machine.

(f) The shovel dipper shall rest on the ground or on blocking during shut down periods.

(g) Shovels shall be inspected daily and all defects promptly repaired.

(h) All rubber tired mobile cranes shall be equipped with outriggers and sufficient blocking to properly stabilize crane while operating.

(i) Rubber tired mobile cranes shall be equipped with rear view mirrors.

(j) Positive boom stops shall be provided on all mobile cranes of the wheel and crawler type.

(k) Length of a crane boom and amount of counterweight shall not exceed manufacturer's rated capacity for equipment involved; except on isolated cases where permission is granted by the department.

(l) On all cranes where wedge brackets are used as terminal connections, the proper size wedge shall be used.

(m) On all mobile cranes, the hoist and boom drums shall be provided with a positive operated pawl or dog which shall be used in addition to the brake to hold the load and boom when they are suspended. Counterweight operated dogs are prohibited.

(n) Oiling and greasing shall be done under safe conditions with machine at rest, except when motion of machine is necessary.

(o) All steps, running boards, and boom ladder shall be of substantial construction and in good repair at all times.

(p) Operators shall not leave the cab while master clutch is engaged.

(q) Fire extinguishers shall be readily accessible and within reach of operator at all times.

(r) All shovel and crane cabs shall be kept clean and free of excess oil and grease on floor and machinery. Oily and greasy rags shall be disposed of immediately after use and not allowed to accumulate.

(s) Tools shall not be left on the cab floor. Spare cans of oil or fuel, and spare parts, shall not be stored in cabs, except in approved racks provided for that purpose.

(t) Mats or planking shall be used in moving shovels or cranes over soft or uneven ground.

(u) Cranes or shovels setting on steep grades shall be securely blocked or secured with a tail hold.

(v) Smoking shall be prohibited while fueling or oiling machines.

(w) Gasoline powered motors shall be stopped during refueling.

(x) Handling of movable feed line (bologna) shall be accomplished with insulated hooks and lineman's rubber gloves.

WAC 296-155-525 (Cont.)

(y) Where cables cross roads they shall be elevated or placed in a trench.

(z) On all power shovels, including back-hoe types, of one-half cubic yard capacity or over, and on all dragline cranes or all-purpose cranes of the crawler or wheel type, two persons shall constitute the minimum working crew. It is mandatory that one be a qualified operator of the equipment in use. The job title of the other crew member may be oiler, rigger, signal person, or a laborer. The primary purpose of the second crew member is to signal the operator when the operator's vision is impaired or obscured and to be on-hand in case of emergency.

(i) Second-crew persons shall be properly trained in their second-person required skills.

(ii) The second crew member shall be close enough to the machine in operation to be aware of any emergency, if one arises, and to assure the machine is operated with necessary and appropriate signals to the operator.

[Statutory Authority: RCW 49.17.010, .040, .050, and .060. 05-03-093 (Order 04-41), § 296-155-525, filed 01/18/05, effective 03/01/05. Statutory Authority: RCW 49.17.010, .040, .050, and .060. 04-14-028 (Order 01-12), § 296-155-525, filed 06/29/04, effective 01/01/05. Statutory Authority: RCW 49.17.010, .040, .050. 02-12-098 (Order 00-20), § 296-155-525, filed 06/05/02, effective 08/01/02. Statutory Authority: Chapter 49.17 RCW. 95-17-036 (Order 95-04), § 296-155-525, filed 8/9/95, effective 9/25/95; 91-03-044 (Order 90-18), § 296-155-525, filed 1/10/91, effective 2/12/91; Order 76-29, § 296-155-525, filed 9/30/76; Order 74-26, § 296-155-525, filed 5/7/74, effective 6/6/74.]

WAC 296-155-526 Crane attached personnel platforms.

(1) Scope, application, and definitions.

(a) Scope and application. This standard applies to the design, construction, testing, use and maintenance of personnel platforms, and the hoisting of personnel platforms attached to the boom of cranes. Crane attached personnel platforms must meet the applicable requirements for design, inspection, construction, testing, maintenance, and operation as prescribed in the ASME B30.23-1998 safety code for Personnel Lifting Systems.

(b) Definitions. For the purposes of this section, the following definitions apply:

"Failure" means load refusal, breakage, or separation of components.

"Lift" (or lifting) refers to all crane functions such as hoisting, lowering, swinging, booming in and out or up and down, or moving an attached personnel platform.

"Load refusal" means the point where the ultimate strength is exceeded.

"Runway" means a firm, level surface, designed, prepared, and designated as a path of travel for the weight and configuration of the crane being used to lift and travel with the attached crane platform. An existing surface may be used as long as it meets these criteria.

(2) General requirements. The use of a crane to hoist employees on a personnel platform is prohibited, except when the erection, use, and dismantling of conventional means of reaching the worksite, such as a personnel hoist, ladder, stairway, aerial lift, elevating work platform or scaffold, would be more hazardous, or is not possible because of structural design or worksite conditions.

(3) Cranes requirements.

(a) All lifting operations must be performed in accordance with the manufacturer's requirements.

(b) Hoist lines must be removed and stowed or an anti two-block device installed.

WAC 296-155-526 (Cont.)

(c) Lifting of the personnel platform must be performed in a slow, controlled manner with no sudden movements of the crane or the platform.

(d) Load and boom hoist drum brakes, swing brakes, and locking devices, such as pawls or dogs, must be engaged when the personnel platform is occupied in a stationary working position.

(e) The crane must be uniformly level within one percent of level grade and located on firm footing. Cranes equipped with outriggers must follow manufacturer's requirements for use.

(f) The total weight of the loaded personnel platform must not exceed fifty percent of the rated capacity for the radius and configuration of the crane as required by load chart specifications.

(g) The use of machines having live booms (booms in which lowering is controlled by a brake without aid from other devices which slow the lowering speeds) is prohibited.

(4) Instruments and components.

(a) Cranes with variable angle booms must be equipped with a boom angle indicator, readily visible to the operator.

(b) Cranes with telescoping booms must be equipped with a device that at all times clearly indicates the boom's extended length to the operator. An accurate determination of the load radius, to be used during the lift, must be made before hoisting personnel.

(5) Personnel platforms - design criteria.

(a) A qualified engineer must design the personnel platform and attachment system.

(b) The attachment system must be designed to minimize tipping of the platform to no more than ten degrees from horizontal.

(c) The platform design must incorporate a motion control device that stabilizes the platform while being held in a working position.

(d) The personnel platform, excluding the guardrail system and body harness anchorages, must be capable of supporting, without failure, its own weight and at least five times the maximum intended load-based on a minimum allowance of five hundred pounds for the first person with light tools, and an additional two hundred fifty pounds for each additional person.

(e) Criteria for guardrail systems contained in chapter 296-155 WAC, Part K and body harness anchorages are contained in chapter 296-155 WAC, Part C will be followed.

(f) A plate or other permanent marking which indicates the weight of the platform and its rated load capacity or maximum intended load, must be conspicuously posted on the personnel platform.

(6) Platform specifications.

(a) Each personnel platform must be equipped with a guardrail system which meets the requirements of chapter 296-155 WAC, Part K. The personnel platform must also be enclosed at least from the toeboard to mid-rail with either solid construction or expanded metal having openings no greater than one-half inch (1.27 cm).

WAC 296-155-526 (Cont.)

(b) A grab rail must be installed inside the entire perimeter of the personnel platform.

(c) Access gates, if installed, must not swing outward during hoisting.

(d) Access gates, including sliding or folding gates, must be equipped with a restraining device to prevent accidental opening.

(e) Employees must have sufficient headroom to stand upright on the platform.

(f) All rough edges exposed to contact by employees must be surfaced or smoothed in order to prevent injury to employees from punctures or lacerations.

(g) A qualified welder familiar with the weld grades and types must perform all welding of the personnel platform and its components, with material specified in the platform design.

(7) Personnel platform loading.

(a) The personnel platform must not be loaded in excess of its rated load capacity.

(b) The number of employees on the personnel platform must not exceed the number required for the work to be performed.

(c) Personnel platforms must be used only for employees, tools, and materials necessary to do the work. Personnel platforms will not be used to hoist materials or tools without an employee on the platform (except to perform a trial lift or proof test as described in subsection (8) of this section).

(d) Materials and tools must be secured to prevent displacement.

(e) Materials and tools must be evenly distributed, within the confines of the platform, while work is being performed.

(f) Employees must keep their feet in contact with the floor of the platform at all times.

(8) Prelift meeting.

(a) A meeting attended by the crane operator, signal person(s) (if necessary for the lift), employee(s) to be lifted, and the person responsible for the task to be performed must be held to review the appropriate requirements of this section and the procedures to be followed.

(b) This meeting must be held before the trial lift at each new work location, and must be repeated for any employees newly assigned to the operation.

(9) Trial lift, inspection, and proof testing.

(a) A trial lift with an unoccupied personnel platform loaded at least to the anticipated lift weight must be made from ground level, or any other location where employees will enter the platform, to each location at which the personnel platform is to be hoisted and positioned. This trial lift must be performed immediately prior to allowing employees on the platform. The operator must determine that:

- All systems, controls, and safety devices are activated and functioning properly;
- No interferences exist; and

WAC 296-155-526 (Cont.)

- All configurations necessary to reach work locations will allow the operator to remain under the fifty percent limit of the crane's rated capacity.
- Materials and tools to be used during the actual lift must be loaded in the platform, as provided in subsection (7) of this section, for the trial lift.

Note: A single trial lift may be performed for all locations that are to be reached from a single set-up position.

(b) The trial lift must be repeated:

- Prior to hoisting employees whenever the crane is moved and set up in a new location, or returned to a previously used location.
- A meeting attended by the crane operator, signal person(s) (if necessary for the lift), employee(s) to be lifted, and the person responsible for the task to be performed must be held to review the appropriate requirements of this section and the procedures to be followed.

(c) After the trial lift:

- But prior to hoisting personnel, the platform must be hoisted a few inches and inspected to ensure that it is secure and properly balanced.
- A visual inspection of the crane, personnel platform, and the crane base support or ground must be conducted by a competent person to determine whether the testing has exposed any defect or produced any adverse effect upon any component or structure.

(d) Deficiencies found during inspection, or operation, which create a safety hazard, must be corrected before hoisting personnel.

(e) The platform must be proof tested:

- At each job site;
- Prior to hoisting employees on the personnel platform; and
- After any repair or modification.

(i) For the proof test, one hundred twenty-five percent of the platform's rated capacity will be hoisted and held in a suspended position for five minutes. The proof test load must be evenly distributed on the platform.

(ii) After each proof test a competent person must inspect the platform and rigging.

(iii) Deficiencies found during proof testing must be corrected, and another proof test conducted. Employees must not be hoisted until a deficiency free proof test has been achieved.

Note: Proof testing may be done concurrently with the required trial lift.

(10) Work practices.

(a) Employees must keep all parts of the body inside the platform during raising, lowering, and positioning, except when performing the duties of a signal person.

WAC 296-155-526 (Cont.)

(b) Before entering or exiting a personnel platform that is not landed, the platform must be secured to the structure where the work is to be performed, unless securing to the structure creates an unsafe situation.

(c) The crane operator must remain at the controls at all times when the platform is occupied.

(d) Employee lifting must be promptly discontinued upon indication of any dangerous weather conditions.

(e) Employees being lifted must remain in continuous sight of and in direct communication with the operator or signal person. Any disruption in communications will cause operations to be immediately discontinued. Signals to the operator will be in accordance with section 5-3.3, ASME B30.5 1994 and this section.

(f) In situations where direct visual contact with the operator is not possible, or the use of a signal person may be hazardous for that person, direct communication alone, such as by radio, may be used. If a secure radio frequency is not available, hard-wired voice communication will be used. When using voice commands, there will be a continuous pause between commands of one-second duration per ten feet to the desired lift height or any contact point.

(g) The following voice commands are recommended for use:

- Boom up.
- Boom down.
- Swing left.
- Swing Right.
- Extend out.
- Retract in.
- Stop.

Note: If special voice commands are required to perform the lift safely, they must be mutually agreed upon between the designated signal person and the crane operator before the lift procedure starts.

(h) Employees on a personnel platform must use a full body harness system with lanyard appropriately attached to a structural member within the personnel platform capable of supporting a fall impact for employees using the anchorage as specified in chapter 296-155 WAC, Part C.

(i) Lifts must not be made on the crane's load lines while personnel are working from an attached platform.

(11) Traveling.

(a) Lifting of employees while the crane is traveling is prohibited, except for portal, tower and locomotive cranes, or where the employer demonstrates that there is no less hazardous way to perform the work.

(b) Under any circumstances where a crane would travel while lifting personnel, the employer must implement the following procedures to safeguard employees:

(i) Crane travel must be restricted to a fixed track or runway;

WAC 296-155-526 (Cont.)

(ii) Travel must be limited to the load radius of the boom used during the lift; and

(iii) The boom must be parallel to the direction of travel.

(c) A complete trial run must be performed before employees are allowed to occupy the platform.

Note: This trial run can be performed concurrent with the trial lift required by subsection (8) of this section.

(d) If travel is done with a rubber tired-carrier, the condition and air pressure of the tires must be checked. The chart capacity for lifts on rubber must be used for application of the fifty percent reduction of rated capacity. Notwithstanding the requirements of subsection (3) of this section, outriggers may be partially retracted as necessary for travel.

(12) Communication. When using verbal signals, clarity and precision are essential for safe operation. Operators must be able to communicate with others at the worksite sufficiently to understand the signs, notices, operation instructions, and the signal code to be used.

[Statutory Authority: RCW 49-17.010, .040, .050. 00-15-028 (Order 99-39), § 296-155-526, filed 07/12/2000, effective 10/01/2000.]

WAC 296-155-527 Appendix A to WAC 296-155-525. Due to crane design configuration to maintain mobility, sheave diameters and rope, design factors are limited. Because of these limited design parameters, inspection to detect deterioration in accordance with subsections below and timely replacement are essential.

(1) Frequent inspection.

(a) All running ropes in service should be visually inspected once each working day. A visual inspection shall consist of observation of all rope which can reasonably be expected to be in use during the day's operations. These visual observations should be concerned with discovering gross damage, such as listed below, which may be an immediate hazard:

(i) Distortion of the rope such as kinking, crushing, unstranding, birdcaging, main strand displacement, or core protrusion. Loss of rope diameter in a short rope length or unevenness of outer strands should provide evidence that the rope or ropes must be replaced.

(ii) General corrosion.

(iii) Broken or cut strands.

(iv) Number, distribution and type of visible broken wires. (See subsection below for further guidance.)

(v) Core failure in rotation resistant ropes. When such damage is discovered the rope shall be either removed from service or given an inspection as detailed in periodic inspection.

(b) Care shall be taken when inspecting sections of rapid deterioration such as flange points, crossover points and repetitive pickup points on drums.

(c) Care shall be taken when inspecting certain ropes such as the following:

(i) Rotation resistant ropes, because of their higher susceptibility to damage and increased deterioration when working on equipment with limited design parameters. The internal deterioration of rotation resistant ropes may not be readily observable.

WAC 296-155-527 (Cont.)

(ii) Boom hoist ropes, because of the difficulties of inspection and the important nature of these ropes.

(2) Periodic inspection.

(a) The inspection frequency shall be determined by a qualified person and shall be based on such factors as expected rope life as determined by experience on the particular installation or similar installations, severity of environment, percentage of capacity lifts, frequency rates of operation, and exposure to shock loads. Inspections need not be at equal calendar intervals and should be more frequent as the rope approaches the end of its useful life. This inspection shall be performed at least annually.

(b) Periodic inspections shall be performed by a qualified person. This inspection shall cover the entire length of rope. Only the surface wires of the rope need be inspected. No attempt should be made to open the rope. Any deterioration resulting in an appreciable loss of original strength, such as described below, shall be noted and determination made as to whether further use of the rope would constitute a hazard:

(i) Points listed in subsection (1) of this section (Frequent inspection).

(ii) Reduction of rope diameter below nominal diameter due to loss of core support, internal or external corrosion, or wear of outside wires.

(iii) Severely corroded or broken wires at end connections.

(c) Care shall be taken when inspecting sections of rapid deterioration, such as the following:

(i) Sections in contact with saddles, equalizer sheaves, or other sheaves where rope travel is limited;

(ii) Sections of the rope at or near terminal ends where corroded or broken wires may protrude.

(3) Rope replacement.

(a) No precise rules can be given for determination of the exact time for replacement of rope, since many variable factors are involved. Continued use in this respect depends largely upon good judgment by an appointed or authorized person in evaluating remaining strength in a used rope after allowance for deterioration disclosed by inspection. Continued rope operations depends upon this remaining strength.

(b) Conditions such as the following shall be sufficient reason for questioning continued use of the rope or increasing the frequency of inspection:

(i) In running ropes, six randomly distributed broken wires in one lay or three broken wires in one strand in one lay (for special conditions relating to rotation resistant rope refer to paragraph 5-3.2.1.1(d)(1)(b) ANSI\ASME B30.5 1989).

(ii) One outer wire broken at the point of contact with the core of the rope which has worked its way out of the rope structure and protrudes or loops out from the rope structure. Additional inspection of this section is required.

WAC 296-155-527 (Cont.)

(iii) Wear of one-third the original diameter of outside individual wires.

(iv) Kinking, crushing, birdcaging, or any other damage resulting in distortion of the rope structure.

(v) Evidence of any heat damage from any cause.

(vi) Reductions from nominal diameter of more than:

(A) 1/64 in. (0.4 mm) for diameters up to and including 5/16 in. (8.0 mm);

(B) 1/32 in. (0.8 mm) for diameters 3/8 in. (9.5 mm) to and including 1/2 in. (13.0 mm);

(C) 3/64 in. (1.2 mm) for diameters 9/16 in. (14.5 mm) to and including 3/4 in. (19.0 mm);

(D) 1/16 in. (1.6mm) for diameters 7/8 in. (22.0 mm) to and including 1 1/8 in. (29.0 mm);

(E) 3/32 in. (2.4 mm) for diameters 1 1/4 in. (32.0 mm) to and including 1 1/2 in. (38.0 mm).

(vii) In standing ropes, more than two broken wires in one lay in sections beyond end connections or more than one broken wire at an end connection.

(c) Replacement rope shall have a strength rating at least as great as the original rope furnished or recommended by the crane manufacturer. Any deviation from the original size, grade, or construction shall be specified by a rope manufacturer, the crane manufacturer or a qualified person.

(d) Rope not in regular use. All rope which has been idle for a period of a month or more due to shutdown or storage of a crane on which it is installed shall be given an inspection before it is placed in service. This inspection shall be for all types of deterioration and shall be performed by an appointed or authorized person.

(e) Inspection records:

(i) Frequent inspection; no records required.

(ii) Periodic inspection: In order to establish data as a basis for judging the proper time for replacement, a dated report of rope condition at each periodic inspection shall be kept on file. This report shall cover points of deterioration. If the rope is replaced only that part need be recorded.

(f) A long-range inspection program should be established and should include records on the examination of ropes removed from service so that a relationship can be established between visual observation and actual condition of the internal structure.

(4) Rope maintenance.

(a) Rope should be stored to prevent damage or deterioration.

WAC 296-155-527 (Cont.)

(b) Unreeling or uncoiling of rope shall be done as recommended by the rope manufacturer and with care to avoid kinking or inducing a twist.

(c) Before cutting a rope, seizings shall be placed on each side of the place where the rope is to be cut to prevent unlaying of the strands. On preformed rope, one seizing on each side of the cut is required. On nonpreformed ropes of 7/8 in. (22 mm) diameter or smaller, two seizings on each side of the cut are required, and for nonpreformed rope of 1 in. (26 mm) diameter or larger, three seizings on each side of the cut are required.

(d) During installation, care should be exercised to avoid dragging of the rope in dirt or around objects which will scrape, nick, crush, or induce sharp bends in it.

(e) Rope should be maintained in a well lubricated condition. It is important that lubricant applied as part of a maintenance program shall be compatible with the original lubricant, and to this end, the rope manufacturer should be consulted; lubricant applied shall be of the type which does not hinder visual inspection. Those sections of rope which are located over sheaves or otherwise hidden during inspection and maintenance procedures require special attention when lubricating rope. The object of rope lubrication is to reduce internal friction and to prevent corrosion.

(f) When an operating rope shows greater wear at well-defined localized areas than on the remainder of the rope, rope life can be extended (in cases where a reduced rope length is adequate) by cutting off a section at the worn end, and thus shifting the wear to different areas of the rope.

(5) Operating near electric power lines:

(a) Cranes shall be operated so that no part of the crane or load enters into the danger zone.

Exceptions: *The danger zone may be entered if the electrical distribution and transmission lines have been de-energized and visibly grounded at the point of work; or the danger zone may be entered if insulating barriers (not a part of nor an attachment to the crane) have been erected to prevent physical contact with the lines.*

(i) For lines rated 50 kV. or below, minimum clearance between the lines and any part of the crane or load (including handling appendages) shall be 10 feet (3 m).

(ii) Caution shall be exercised when working near overhead lines because they can move horizontally or vertically due to wind, moving the danger zone to new positions.

(iii) While in transit with no load and boom lowered, the clearance shall be as specified in WAC 296-155-525 (3)(e).

(iv) A qualified signal person shall be assigned to observe the clearance when the crane moves to within a boom's length of the limits specified in WAC 296-155-525 (3)(e). The operator is not in the best position to judge distance between the power line and the crane or its protuberances.

(b) If cage-type boom guards, insulating links, or proximity warning devices are used on cranes, such devices shall not be a substitute for the requirements of WAC 296-155-525 (3)(e), even if such devices are required by law or regulation. In view of the complex, invisible, and lethal nature of the electrical hazard involved, and to lessen the potential of false security, limitations of such devices, if used, shall be understood by operating personnel and tested in the manner and intervals

WAC 296-155-527 (Cont.)

prescribed by the manufacturer of the device. Compliance with WAC 296-155-525 (3)(e) is the recommended practice of this regulation in determining permissible proximity of the crane and its protuberances, including load, to electrical power lines.

(c) Before the commencement of operations near electrical lines, the person responsible for the job shall notify the owners of the lines or their authorized representatives, provide them with all pertinent information, and request their cooperation.

(d) Any overhead wire shall be considered to be an energized line unless and until the person owning such line or the electrical utility authorities verify that it is not an energized line.

(e) Exceptions to this procedure, if approved by the owner of the electrical lines, may be granted by the administrative or regulatory authority if the alternate procedure provides protection and is set forth in writing.

(f) Durable signs shall be installed at the operator's station and on the outside of the crane warning that electrocution or serious bodily injury may occur unless a minimum clearance of 10 feet (3 m) is maintained between the crane or the load being handled and energized power lines. Greater clearances are required because of higher voltage as stated in WAC 296-155-525 (3)(e). These signs shall be revised when local jurisdiction requires greater clearances.

(6) Site preparation and erection.

(a) All load bearing foundations, supports, and rail tracks shall be constructed or installed to support the crane loads and to transmit them to the soil or other support medium. In addition to supporting vertical load, foundations and supports, rail supports excepted, should be designed to provide a moment resisting overturning equal to a minimum of 150% of the maximum crane overturning moment.

(b) Rails should be level and straight, unless specifically designed for curves or grades, and properly spaced for the crane trucks in accordance with the manufacturer's specifications. The track and support system should have sufficient rigidity to limit dynamic oscillations and deviations from plumb.

(c) Rails shall be securely attached to the supporting surface in a manner capable of resisting the horizontal and vertical loads specified by the manufacturer. When applicable, provisions should be made for thermal expansion and contraction.

(d) Splices in rail tracks (bolted or welded) shall have smooth joints.

(e) When required, a designated portion of the track should be arranged and constructed as an out-of-service parking area complete with means needed for supporting the crane against storm wind effects and anchoring it against unwanted movement along the track; the parking track should be in place before erection commences.

(f) Rails shall be electrically grounded when they carry cranes electrically powered from an outside source.

(g) Both ends of all tracks shall be provided with stops or buffers adjusted for simultaneous contact with both sides of the travel base.

WAC 296-155-527 (Cont.)

(h) When more than one crane will be operating on a run of track, particular consideration should be given to the number and disposition of parking areas.

(i) The hazard of earthquake effects appropriated to the site or zone should be considered.

(j) The crane manufacturer shall provide maximum resulting loads at the base of the crane, or wheel loads, for use in design of the supports.

(7) General erection requirements.

(a) When cranes are erected, the manufacturer's or a qualified person's written erection instructions and a list of the weights of each component to be erected shall be at the site.

(b) Cranes shall be erected in accordance with the crane manufacturer's or a qualified person's recommendations. Erection shall be performed under the supervision of a qualified person.

(c) Procedures shall be established before erection work commences to implement the erection instructions and to adapt them to the particular needs of the site. The need for temporary guying and bracing during erection shall be established.

(d) Before crane components are erected, they shall be visually inspected for damage. Damaged members shall not be erected until repaired in accordance with the manufacturer's or qualified person's instructions, or replaced.

(e) Slings and lifting accessories shall be selected and arranged to avoid damaging or marring crane members during erection.

(f) Wind velocity at the site at the time of erection should be considered as a limiting factor that could require suspending the erection operation.

(g) Crane towers shall be erected plumb to a tolerance that is specified by the manufacturer.

(h) Cranes required to weathervane when out-of-service shall be installed with clearance for the boom and superstructure to swing a full 360^{o} arc without striking a fixed object or other crane.

[Statutory Authority: Chapter 49.17.RCW. 97-11-055 (Order 96-15), § 296-155-527, filed 05/20/97, effective 08/01/97. 95-17-036 (Order 95-04), § 296-155-527, filed 8/9/95, effective 9/25/95.]

WAC 296-155-528 Crane or derrick suspended personnel platforms.

(1) Scope, application, and definitions.

(a) Scope and application. This standard applies to the design, construction, testing, use and maintenance of personnel platforms, and the hoisting of personnel platforms on the load lines of cranes or derricks.

(b) Definitions. For the purposes of this section, the following definitions apply:

(i) **"Failure"** means load refusal, breakage, or separation of components.

(ii) **"Hoist"** (or hoisting) means all crane or derrick functions such as lowering, lifting, swinging, booming in and out or up and down, or suspending a personnel platform.

WAC 296-155-528 (Cont.)

(iii) **"Load refusal"** means the point where the ultimate strength is exceeded.

(iv) **"Maximum intended load"** means the total load of all employees, tools, materials, and other loads reasonably anticipated to be applied to a personnel platform or personnel platform component at any one time.

(v) **"Runway"** means a firm, level surface designed, prepared, and designated as a path of travel for the weight and configuration of the crane being used to lift and travel with the crane suspended platform. An existing surface may be used as long as it meets these criteria.

(2) General requirements. The use of a crane or derrick to hoist employees on a personnel platform is prohibited, except when the erection, use, and dismantling of conventional means of reaching the worksite, such as a personnel hoist, ladder, stairway, aerial lift, elevating work platform or scaffold, would be more hazardous, or is not possible because of structural design or worksite conditions.

(3) Cranes and derricks.

(a) Operational criteria.

(b) Hoisting of the personnel platform shall be performed in a slow, controlled, cautious manner with no sudden movements of the crane or derrick, or the platform.

(c) Load lines shall be capable of supporting, without failure, at least seven times the maximum intended load, except that where rotation resistant rope is used, the lines shall be capable of supporting without failure, at least ten times the maximum intended load. The required design factor is achieved by taking the current safety factor of 3.5 (required under WAC 296-155-525 (4)(b)) and applying the fifty percent derating of the crane capacity which is required by (f) of this subsection.

(d) Load and boom hoist drum brakes, swing brakes, and locking devices such as pawls or dogs shall be engaged when the occupied personnel platform is in a stationary working position.

(e) The crane shall be uniformly level within one percent of level grade and located on firm footing. Cranes equipped with outriggers shall have them all fully deployed following manufacturer's specifications, insofar as applicable, when hoisting employees.

(f) The total weight of the loaded personnel platform and related rigging shall not exceed fifty percent of the rated capacity for the radius and configuration of the crane or derrick.

(g) The use of machines having live booms (booms in which lowering is controlled by a brake without aid from other devices which slow the lowering speeds) is prohibited.

(h) Multiple-part line block: When a multiple-part line block is in use, a substantial strap shall be used between the crane hook and common ring, shackle, or other equivalent device, to eliminate employee exposure to the lines running through the block, and to the block itself.

(4) Instruments and components.

(a) Cranes and derricks with variable angle booms shall be equipped with a boom angle indicator, readily visible to the operator.

WAC 296-155-528 (Cont.)

(b) Cranes with telescoping booms shall be equipped with a device to indicate clearly to the operator, at all times, the boom's extended length, or an accurate determination of the load radius to be used during the lift shall be made prior to hoisting personnel.

(c) A positive acting device shall be used which prevents contact between the load block or overhaul ball and the boom tip (anti-two-blocking device), or a system shall be used which deactivates the hoisting action before damage occurs in the event of a two- blocking situation (two block damage prevention feature).

(d) The load line hoist drum shall have a system or device on the power train, other than the load hoist brake, which regulates the lowering rate of speed of the hoist mechanism (controlled load lowering). Free fall is prohibited.

(5) Rigging.

(a) Lifting bridles on box-type platforms shall consist of four legs of equal length, with one end securely shackled to each corner of the platform and the other end securely attached to a common ring, shackle, or other equivalent device to accommodate the crane hook, or a strap to the crane hook.

(b) Shackle bolts used for rigging of personnel platforms shall be secured against displacement.

(c) A substantial safety line shall pass through the eye of each leg of the bridle adjacent to the common ring, shackle, or equivalent device.

(d) Securely fastened with a minimum amount of slack to the lift line above the headache ball or to the crane hook itself.

(e) All eyes in wire rope slings shall be fabricated with thimbles.

(f) Wire rope, shackles, rings, master links, and other rigging hardware must be capable of supporting, without failure, at least five times the maximum intended load applied or transmitted to that component. Where rotation resistant wire rope is used for slings, they shall be capable of supporting without failure at least ten times the maximum intended load.

(g) Hooks on headache ball assemblies, lower load blocks, or other attachment assemblies shall be of a type that can be closed and locked, eliminating the hook throat opening. Alternatively, an alloy anchor type shackle with a bolt, nut and retaining pin may be used.

(h) Bridles and associated rigging for attaching the personnel platform to the hoist line shall be used only for the platform and the necessary employees, their tools and the materials necessary to do their work, and shall not be used for any other purpose when not hoisting personnel.

(6) Personnel platforms - design criteria.

(a) The personnel platform and suspension system shall be designed by a qualified engineer or a qualified person competent in structural design.

(b) The suspension system shall be designed to minimize tipping of the platform due to movement of employees occupying the platform.

WAC 296-155-528 (Cont.)

(c) The personnel platform itself, except the guardrail system and body harness anchorages, shall be capable of supporting, without failure, its own weight and at least five times the maximum intended load based on a minimum allowance of five hundred pounds for the first person with light tools, and an additional two hundred fifty pounds for each additional person.

(d) Criteria for guardrail systems contained in chapter 296-155 WAC, Part K and body harness anchorages are contained in chapter 296-155 WAC, Part C-1.

(e) The personnel platform shall be conspicuously posted with a plate or other permanent marking which indicates the weight of the platform and its rated load capacity or maximum intended load.

(7) Platform specifications.

(a) Each personnel platform shall be equipped with a guardrail system which meets the requirements of chapter 296-155 WAC, Part K and, shall be enclosed at least from the toeboard to mid-rail with either solid construction or expanded metal having openings no greater than one-half inch (1.27 cm).

(b) A grab rail shall be installed inside the entire perimeter of the personnel platform.

(c) Access gates, if installed, shall not swing outward during hoisting.

(d) Access gates, including sliding or folding gates, shall be equipped with a restraining device to prevent accidental opening.

(e) Headroom shall be provided which allows employees to stand upright in the platform.

(f) In addition to the use of hard hats, employees shall be protected by overhead protection on the personnel platform when employees are exposed to falling objects.

(g) All rough edges exposed to contact by employees shall be surfaced or smoothed in order to prevent injury to employees from punctures or lacerations.

(h) All welding of the personnel platform and its components shall be performed by a qualified welder familiar with the weld grades, types, and material specified in the platform design.

(i) Occupants of all personnel platforms shall wear a safety belt or harness and lanyard which meets the requirements of chapter 296-155 WAC, Part C-1.

(j) Box-type platform: The workers lanyard shall be secured to an anchorage within the platform meeting the requirements of chapter 296-155 WAC, Part C-1.

(k) Rescue platform:

(i) If the platform is used as a rescue vehicle, the injured worker shall be strapped into the stretcher or basket.

(ii) The basket shall then be secured by lanyard to an anchorage within the platform meeting the requirements of chapter 296-155 WAC, Part C-1.

(l) Boatswains chair: The workers lanyard shall be secured to the lift line above the headache ball or to the crane hook itself.

WAC 296-155-528 (Cont.)

(m) Barrel-type platform:

(i) The workers lanyard shall be secured to the lift line above the headache ball or to the crane hook itself.

(ii) A solid bar or rod shall be substantially attached in a rigid position to the bottom or side of the platform.

(iii) The bottom of the barrel-type platform shall be of a convex shape to cause the platform to lay on its side when lowered to the ground or floor.

(iv) The bar or rod shall extend a minimum of eight feet above the floor of the platform.

(v) Workers shall enter and exit from barrel-type platforms only when they are in an upright position, stable, and securely attached to the load line.

(vi) The employer shall use methods or devices which allow employees to safely enter or exit barrel-type platforms.

(8) Personnel platform loading.

(a) The personnel platform shall not be loaded in excess of its rated load capacity.

(b) The number of employees occupying the personnel platform shall not exceed the number required for the work being performed.

(c) Personnel platforms shall be used only for employees, their tools, and the materials necessary to do their work, and shall not be used to hoist only materials or tools when not hoisting personnel.

(d) Materials and tools for use during a personnel lift shall be secured to prevent displacement.

(e) Materials and tools for use during a personnel lift shall be evenly distributed within the confines of the platform while the platform is suspended.

(9) Trial lift, inspection, and proof testing.

(a) A trial lift with the unoccupied personnel platform loaded at least to the anticipated liftweight shall be made from ground level, or any other location where employees will enter the platform, to each location at which the personnel platform is to be hoisted and positioned. This trial lift shall be performed immediately prior to placing personnel on the platform. The operator shall determine that all systems, controls, and safety devices are activated and functioning properly; that no interferences exist; and that all configurations necessary to reach those work locations will allow the operator to remain under the fifty percent limit of the hoist's rated capacity. Materials and tools to be used during the actual lift can be loaded in the platform, as provided in subsection (8)(d) and (e) of this section for the trial lift. A single trial lift may be performed at one time for all locations that are to be reached from a single set-up position.

(b) The trial lift shall be repeated prior to hoisting employees whenever the crane or derrick is moved and set up in a new location or returned to a previously used location. Additionally, the trial lift shall be repeated when the lift route is changed unless the operator determines that the route change is not significant (i.e., the route change would not affect the safety of hoisted employees).

WAC 296-155-528 (Cont.)

(c) After the trial lift, and just prior to hoisting personnel, the platform shall be hoisted a few inches and inspected to ensure that it is secure and properly balanced. Employees shall not be hoisted unless the following conditions are determined to exist:

(i) Hoist ropes shall be free of kinks;

(ii) Multiple part lines shall not be twisted around each other;

(iii) The primary attachment shall be centered over the platform; and

(iv) The hoisting system shall be inspected if the load rope is slack to ensure all ropes are properly stated on drums and in sheaves.

(d) A visual inspection of the crane or derrick, rigging, personnel platform, and the crane or derrick base support or ground shall be conducted by a competent person immediately after the trial lift to determine whether the testing has exposed any defect or produced any adverse effect upon any component or structure.

(e) Any defects found during inspections which create a safety hazard shall be corrected before hoisting personnel.

(f) At each job site, prior to hoisting employees on the personnel platform, and after any repair or modification, the platform and rigging shall be proof tested to one hundred twenty-five percent of the platform's rated capacity by holding it in a suspended position for five minutes with the test load evenly distributed on the platform (this may be done concurrently with the trial lift). After proof testing, a competent person shall inspect the platform and rigging. Any deficiencies found shall be corrected and another proof test shall be conducted. Personnel hoisting shall not be conducted until the proof testing requirements are satisfied.

(10) Work practices.

(a) Employees shall keep all parts of the body inside the platform during raising, lowering, and positioning. This provision does not apply to an occupant of the platform performing the duties of a signal person.

(b) Before employees exit or enter a hoisted personnel platform that is not landed, the platform shall be secured to the structure where the work is to be performed, unless securing to the structure creates an unsafe situation.

(c) Tag lines shall be used unless their use creates an unsafe condition.

(d) The crane or derrick operator shall remain at the controls at all times when the crane engine is running and the platform is occupied.

(e) Hoisting of employees shall be promptly discontinued upon indication of any dangerous weather conditions or other impending danger.

(f) Employees being hoisted shall remain in continuous sight of and in direct communication with the operator or signal person. In those situations where direct visual contact with the operator is not possible, and the use of a signal person would create a greater hazard for that person, direct communication alone such as by radio may be used.

WAC 296-155-528 (Cont.)

(g) Hand signals to the operator shall be in accordance with WAC 296-155-525 (2)(c).

(h) Except over water, employees occupying the personnel platform shall use a full body harness system with lanyard appropriately attached to the lower load block or overhaul ball, or to a structural member within the personnel platform capable of supporting a fall impact for employees using the anchorage as specified in chapter 296-155 WAC, Part C-1. When working over water, the requirements of WAC 296-155-235 shall apply.

No lifts shall be made on another of the crane's or derrick's load lines while personnel are suspended on a platform.

(11) Traveling.

(a) Hoisting of employees while the crane is traveling is prohibited, except for portal, tower and locomotive cranes, or where the employer demonstrates that there is no less hazardous way to perform the work.

(b) Under any circumstances where a crane would travel while hoisting personnel, the employer shall implement the following procedures to safeguard employees:

(i) Crane travel shall be restricted to a fixed track or runway;

(ii) Travel shall be limited to the load radius of the boom used during the lift; and

(iii) The boom must be parallel to the direction of travel.

(c) A complete trial run shall be performed to test the route of travel before employees are allowed to occupy the platform. This trial run can be performed at the same time as the trial lift required by subsection (9)(a) of this section which tests the route of the lift.

(d) If travel is done with a rubber tired-carrier, the condition and air pressure of the tires shall be checked. The chart capacity for lifts on rubber shall be used for application of the fifty percent reduction of rated capacity. Notwithstanding subsection (3)(e) of this section, outriggers may be partially retracted as necessary for travel.

(12) Prelift meeting.

(a) A meeting attended by the crane or derrick operator, signal person(s) (if necessary for the lift), employee(s) to be lifted, and the person responsible for the task to be performed shall be held to review the appropriate requirements of this section and the procedures to be followed.

(b) This meeting shall be held prior to the trial lift at each new work location, and shall be repeated for any employees newly assigned to the operation.

[Statutory Authority: Chapter 49.17.010, .040, .050,.060 RCW. 98-05-046 (Order 97-10), § 296-155-528, filed 2/13/98, effective 4/15/98.]

WAC 296-155-530 Material hoists, personnel hoists, and elevators.

(1) General requirements.

(a) The employer shall comply with the manufacturer's specifications and limitations applicable to the operation of all hoists and elevators. Where the manufacturer's specifications are not available, the limitations assigned to the equipment shall be based on the determinations of a professional engineer competent in the field.

(b) The employer shall ensure that no person shall enter a hoistway, elevator shaft, or similar enclosure in which the hoisting apparatus or vehicle is installed and functioning unless the power source operating those systems is locked out in accordance with WAC 296-155-429.

(c) Rated load capacities, recommended operating speeds, and special hazard warning or instructions shall be posted on cars and platforms.

(d) Wire rope shall be removed from service when any of the following conditions exists:

(i) In hoisting ropes, six randomly distributed broken wires in one rope lay or three broken wires in one strand in one rope lay;

(ii) Abrasion, scrubbing, flattening, or peening, causing loss of more than one-third of the original diameter of the outside wires;

(iii) Evidence of any heat damage resulting from a torch or any damage caused by contact with electrical wires;

(iv) Reduction from nominal diameter of more than three sixty-fourths inch for diameters up to and including three-fourths inch; one-sixteenth inch for diameters seven-eighths to 1 1/8 inches; and three thirty-seconds inch for diameters 1 1/4 to 1 1/2 inches.

(e) Hoisting ropes shall be installed in accordance with the wire rope manufacturer's recommendations.

(f) The installation of live booms on hoists is prohibited.

(g) The use of endless belt-type man lifts on construction shall be prohibited.

(h) Employees shall not be permitted to ride on top of material hoists, personnel hoists or permanent elevators except for purposes of inspection, maintenance, elevator installation or dismantling work.

(2) Material hoists,

(a) (i) Operating rules shall be established and posted at the operator's station of the hoist. Such rules shall include signal system and allowable line speed for various loads. Rules and notices shall be posted on the car frame or crosshead in a conspicuous location, including the statement “No riders allowed.”

(ii) No person shall be allowed to ride on material hoists except for the purposes of inspection and maintenance.

WAC 296-155-530 (Cont.)

(b) All entrances of the hoistways shall be protected by substantial gates or bars which shall guard the full width of the landing entrance. All hoistway entrance bars and gates shall be painted with diagonal contrasting colors, such as black and yellow stripes.

(i) Bars shall be not less than 2- by 4-inch wooden bars or the equivalent, located 2 feet from the hoistway line. Bars shall be located not less than 36 inches nor more than 42 inches above the floor.

(ii) Gates or bars protecting the entrances to hoistway shall be quipped with a latching device.

(c) Overhead protective covering of two-inch planking, 3/4-inch plywood or other solid material of equivalent strength shall be provided on the top of every material hoist cage or platform to prevent objects falling on the workers loading or unloading the hoist.

(i) The protective covering on the top of the cage or platform may be made in hinged sections that may be raised when hoisting long material.

(ii) When using a cage or platform for long material, the several pieces of the material shall be securely fastened together and made fast to the cage or platform, so that no part of the load can fall or project beyond the sides of the cage or platform.

(d) The operator's station of a hoisting machine shall be provided with overhead protection equivalent to tight planking not less than 2 inches thick. The support for the overhead protection shall be of equal strength.

(e) Hoist towers may be used with or without an enclosure on all sides. However, whichever alternative is chosen, the following applicable conditions shall be met:

(i) When a hoist tower is enclosed, it shall be enclosed on all sides for its entire height with a screen enclosure of 1/2-inch mesh, No. 18 U.S. gauge wire or equivalent, except for landing access.

(ii) When a hoist tower is not enclosed, the hoist platform or car shall be totally enclosed (caged) on all sides for the full height between the floor and the overhead protective covering with 1/2-inch mesh of No. 14 U.S. gauge wire or equivalent. The hoist platform enclosure shall include the required gates for loading and unloading. A 6-foot high enclosure shall be provided on the unused sides of the hoist tower at ground level.

(f) Car arresting devices shall be installed to function in case of rope failure.

(g) All material hoist towers shall be designed by a licensed professional engineer.

(h) All material hoists shall conform to the requirements of ANSI A10.5-1969, Safety Requirements for Material Hoists.

(3) Personnel hoists.

(a) Personnel hoists shall be provided for access and egress on all multi story buildings where vertical travel exceeds sixty feet from a ground level access point.

WAC 296-155-530 (Cont.)

(b) Hoist towers outside the structure shall be enclosed for the full height on the side or sides used for entrance and exit to the structure. At the lowest landing, the enclosure on the sides not used for exit or entrance to the structure shall be enclosed to a height of at least 10 feet. Other sides of the tower adjacent to floors or scaffold platforms shall be enclosed to a height of 10 feet above the level of such floors or scaffolds.

(c) Towers inside of structures shall be enclosed on all four sides throughout the full height.

(d) Towers shall be anchored to the structure at intervals not exceeding 25 feet. In addition to tie-ins, a series of guys shall be installed. Where tie-ins are not practical the tower shall be anchored by means of guys made of wire rope at least one-half inch in diameter, securely fastened to anchorages to ensure stability.

(e) Hoistway doors or gates shall be not less than 6 feet 6 inches high and shall be provided with mechanical locks which cannot be operated from the landing side, and shall be accessible only to persons on the car.

(f) Cars shall be permanently enclosed on all sides and the top, except sides used for entrance and exit, which have car gates or doors.

(g) A door or gate shall be provided at each entrance to the car which shall protect the full width and height of the car entrance opening.

(h) Overhead protective covering of 2-inch planking, 3/4-inch plywood or other solid material of equivalent strength shall be provided on the top of every personnel hoist.

(i) Doors or gates shall be provided with electric contacts which do not allow movement of the hoist when door or gate is open.

(j) A signal device shall be installed in the elevator car and only operated by an attendant who shall give the signals for operation, when transporting workers.

(k) An electrical push button signalling device or other approved signalling system shall be provided at each floor landing connected to an annunciator in the car. The signal code shall be posted adjacent to the signal device at each and every work level and at operator's work level. All wording shall be black on a white card, in large clear letters.

(l) The elevator machine and controls shall be housed in as a protection against accidents and the weather, and the door kept locked against unauthorized entrance when operator is not in attendance.

(m) Safeties shall be capable of stopping and holding the car and rated load when traveling at governor tripping speed.

(n) Cars shall be provided with a capacity and data plate secured in a conspicuous place on the car or crosshead.

(o) Internal combustion engines shall not be permitted for direct drive.

(p) Normal and final terminal stopping devices shall be provided.

WAC 296-155-530 (Cont.)

(q) An emergency stop switch shall be provided in the car and marked "stop."

(r) Ropes:

(i) The minimum number of hoisting ropes used shall be three for traction hoists and two for drum-type hoists.

(ii) The minimum diameter of hoisting and counterweight wire ropes shall be 1/2-inch.

(iii) Safety factors:

MINIMUM FACTORS OF SAFETY FOR SUSPENSION WIRE ROPES	
Rope speed in feet per minute:	**Minimum factor of Safety:**
50	7.60
75	7.75
100	7.95
125	8.10
150	8.25
175	8.40
200	8.60
225	8.75
250	8.90
300	9.20
350	9.50
400	9.75
450	10.00
500	10.25
550	10.45
600	10.70

(s) Following assembly and erection of hoists, and before being put in service, an inspection and test of all functions and safety devices shall be made under the supervision of a competent person. A similar inspection and test is required following major alteration of an existing installation. All hoists shall be inspected and tested at not more than 3-month intervals. Records shall be maintained and kept on file for the duration of the job.

(t) All personnel hoists used by employees shall be constructed of materials and components which meet the specifications for materials, construction, safety devices, assembly, and structural integrity as stated in the American National Standard A10.4-1963, Safety Requirements for Workmen's Hoists. The requirements of this subdivision do not apply to cantilever type personnel hoists.

(u) Wire rope shall be taken out of service when any of the following conditions exist:

(i) In running ropes, six randomly distributed broken wires in one lay or three broken wires in one strand in one lay;

WAC 296-155-530 (Cont.)

(ii) Wear of one-third the original diameter of outside individual wires. Kinking, crushing, bird caging, or any other damage resulting in distortion of the rope structure;

(iii) Evidence of any heat damage from any cause;

(iv) Reductions from nominal diameter of more than three-sixty-fourths inch for diameters to and including three-fourths inch, one sixteenth inch for diameter seven-eights inch to 1 1/8 inches inclusive, three-thirty-seconds inch for diameters 1 1/4 to 1 1/2 inches inclusive;

(v) In standing ropes, more than two broken wires in one lay in sections beyond end connections or more than one broken wire at an end connection.

(v) (i) Personnel hoists used in bridge tower construction shall be approved by a registered professional engineer and erected under the supervision of a qualified engineer competent in this field.

(ii) When a hoist tower is not enclosed, the hoist platform or car shall be totally enclosed (caged) on all sides for the full height between the floor and the overhead protective covering with 3/4-inch mesh of No. 14 U.S. gauge wire or equivalent. The hoist platform enclosure shall include the required gates for loading and unloading.

(iii) These hoists shall be inspected and maintained on a weekly basis. Whenever the hoisting equipment is exposed to winds exceeding 35 miles per hour it shall be inspected and put in operable condition before reuse.

(4) All elevators, manlifts or other lifting devices must be installed and maintained in conformity with the requirements specified in the Washington state elevator laws and regulations adopted by the elevator section of the department of labor and industries.

Note: For additional information refer to chapter 296-100 WAC, safety requirements for material hoists.
[Statutory Authority: RCW 49.17.010, .040, .050. 02-12-098 (Order 00-20), § 296-155-530, filed 06/05/02, effective 08/01/02. Statutory Authority: Chapter 49.17 RCW. 94-15-096 (Order 94-07), § 296-155-530, filed 7/20/94, effective 9/20/94; 91-03-044 (Order 90-18), § 296-155-530, filed 1/10/91, effective 2/12/91. Statutory Authority: RCW 49.17.040 and 49.17.050. 86-03-074 (Order 86-14), § 296-155-530, filed 1/21/86; Order 74-26, § 296-155-530, filed 5/7/74, effective 6/6/74.]

WAC 296-155-535 Base-mounted drum hoists.

(1) General requirements.

(a) Exposed moving parts such as gears, projecting screws, setscrews, chain, cables, chain sprockets, and reciprocating or rotating parts, which constitute a hazard, shall be guarded.

(b) All controls used during the normal operation cycle shall be located within easy reach of the operator's station.

(c) Electric motor operated hoists shall be provided with:

(i) A device to disconnect all motors from the line upon power failure and not permit any motor to be restarted until the controller handle is brought to the “off” position;

WAC 296-155-535 (Cont.)

(ii) Where applicable, an overspeed preventive device;

(iii) A means whereby remotely operated hoists stop when any control is ineffective.

(d) All base-mounted drum hoists in use shall meet the applicable requirements for design, construction, installation, testing, inspection, maintenance, and operation, as prescribed by the manufacturer.

(2) Specific requirements. (Reserved.)
[Order 74-26, § 296-155-535, filed 5/7/74, effective 6/6/74.]

WAC 296-155-540 Overhead hoists.

(1) General requirements.

(a) The safe working load of the overhead hoist, as determined by the manufacturer, shall be indicated on the hoist, and this safe working load shall not be exceeded.

(b) The supporting structure to which the hoist is attached shall have a safe working load equal to that of the hoist.

(c) The support shall be arranged so as to provide for free movement of the hoist and shall not restrict the hoist from lining itself up with the load.

(d) The hoist shall be installed only in locations that will permit the operator to stand clear of the load at all times.

(e) Air hoists shall be connected to an air supply of sufficient capacity and pressure to safely operate the hoist. All air hoses supplying air shall be positively connected to prevent their becoming disconnected during use.

(f) All overhead hoists in use shall meet the applicable requirements for construction, design, installation, testing, inspection, maintenance, and operation, as prescribed by the manufacturer.

(2) Specific requirements. (Reserved.)
[Order 74-26, § 296-155-540, filed 5/7/74, effective 6/6/74.]

WAC 296-155-545 Conveyors.

(1) All conveyors in use shall meet the applicable requirements for design, construction, inspection, testing, maintenance, and operation, as prescribed in ANSI B20.1-1976, Safety Code for Conveyors, Cableways, and Related Equipment.

(2) Starting precautions.

(a) When the entire length of a conveyor is visible from the starting switch, the operator shall visually check to make certain that all persons are in the clear before starting the conveyor.

(b) When the entire length of the conveyor is not visible from the starting switch, a positive audible or visible warning system shall be installed and operated to warn persons that the conveyor will be started.

WAC 296-155-545 (Cont.)

(c) All reasonable precautions shall be taken by the operator prior to starting a conveyor, to assure that no person is in a hazardous location where they may be injured when the conveyor is started.

(3) Riding and walking on conveyors.

(a) Riding on conveyor chains, belt, or bucket elevators shall be prohibited.

(b) Persons shall not be allowed to walk on conveyors except for emergency purposes and then only after the conveyor has been de-energized and the person can do so safely.

(c) Riding of conveyors shall only be permitted on the manlift steps and platforms with handholds attached and other safety factors as specified in chapter 296-96 WAC, Safety regulations and fees for all elevators, dumbwaiters, escalators, and other conveyances.

(4) Stop controls.

(a) Means for stopping the motor or engine of a conveyor shall be provided at the operator's station.

(b) If the operator's station is at a remote point, similar provisions for stopping the motor or engine shall be provided at the motor or engine location.

(5) Emergency controls. Emergency stop switches shall be arranged so that the conveyor cannot be started again until the actuating stop switch has been reset to running or “on” position.

(6) Screw type conveyors. Screw or auger type conveyors shall be guarded to prevent employee contact with turning flights.

(7) Overhead conveyors.

(a) Where a conveyor passes over work areas, aisles, or thoroughfares, guards shall be provided to protect persons required to work below the conveyors.

(b) Where a conveyor crosses over an aisle or passageway, it shall be conspicuously marked by suitable signs, as required by Part E of this chapter.

(c) When the return strand of a conveyor operates within seven feet of the floor there shall be a trough provided of sufficient strength to carry the weight resulting from a broken chain. If the strands are over a passageway, a means shall be provided to catch and support the ends of the chain in the event of a break.

(8) Emergency stop.

(a) Conveyors shall be provided with an emergency stopping device (panic-type) which can be reached from the conveyor.

(b) The emergency stopping device shall be located near the material entrance and shall stop the conveyor a sufficient distance away from the hazard to prevent injury.

(c) Where the conveyor leading into such equipment is under constant control of an operator who has full view of the material entrance who is located or restrained where they cannot possibly fall onto the conveyor an emergency stopping device is not mandatory.

WAC 296-155-545 (Cont.)

(9) Conveyor lockout.

(a) Conveyors shall be locked out with a padlock at any time repair, maintenance, or clean-up work is being performed on the conveyor.

(b) Tags or push-button stops are not acceptable.

(10) Where conveyors are in excess of seven feet in height, means shall be provided to safely permit essential inspection and maintenance operations.

(11) Conveyor repair.

(a) Any part showing signs of significant wear shall be inspected carefully and replaced prior to reaching a condition where it may create a hazard.

(b) Replacement parts shall be equal to or exceed the manufacturer's specifications.

[Statutory Authority: RCW 49.17.010, .040, .050, and .060. 06-05-027 (Order 05-45), § 296-155-545, filed 02/07/06, effective 04/01/06. Statutory Authority: Chapter 49.17 RCW. 94-15-096 (Order 94-07), § 296-155-545, filed 7/20/94, effective 9/20/94. Statutory Authority: RCW 49.17.040 and 49.17.050. 86-03-074 (Order 86-14), § 296-155-545, filed 1/21/86; Order 74-26, § 296-155-545, filed 5/7/74, effective 6/6/74.]

WAC 296-155-550 Aerial cableways.

(1) Cableways shall be designed to withstand the maximum required load with a safety factor of five (5) on all its parts.

(2) Safety stay lines shall be installed at anchor ends and equal in strength to the cableway.

(3) Where towers are required they shall be securely guyed or constructed to carry the maximum sustained load.

(4) Towers shall be provided with ladderways to facilitate safe access for repairs and inspections.

(5) Towers shall have sufficient elevation to provide substantial clearance for cableway and loads carried over all contemplated work.

(6) Running lines and sheaves, where accessible, shall be guarded.

(7) The carrier, carrier sheaves, bearings, bucket latch and all working parts shall be lubricated and visually inspected daily.

(8) All the wire ropes shall be kept lubricated with proper lubricant.

(9) Daily visual inspection shall be made of the button line, especially at the buttons where abrasion is caused by the carrier rebound. Rubber and steel ferrule shock absorbers shall be placed at each end of buttons.

(10) All loading, unloading and working stations shall be adequately lighted for night operation. Clearance lights shall be installed on all high points under cableway.

[Order 74-26, § 296-155-550, filed 5/7/74, effective 6/6/74.]

WAC 296-155-555 Gin poles.

(1) Gin poles shall be properly guyed according to the type used.

(2) Anchors may be of "dead men" or attached to some permanent stable structure.

(3) When the guy lines are anchored to a permanent structure, the anchors shall be distant at least one-half the height of the pole from its base, and when "dead men" are used, they shall be located a distant from the base at least one and one-half times the height of the pole.

(4) The pole shall be securely fastened at the foot to prevent kicking out during operation.

(5) Gin poles shall be of selected timber, sound and free from knots or other injurious defects.

(6) Allowable loads for spruce timbers used as gin poles. The allowable loads and the limiting lengths given are based on the U.S. Forest Products Laboratory Standard Recommendations for Spruce of Common Grade, based on pin connected ends for columns.

Actual	Length in feet	Allowable load capacity in tons
6"x6"	10	10.4
6"x6"	15	6.6
6"x6"	20	3.7
6"x6"	25 Max.	2.4
8"x8"	20	11.7
8"x8"	25	7.5
8"x8"	30	5.2
8"x8"	33 4" Max.	4.2
10"x10"	25	18.2
10"x10"	30	12.7
10"x10"	35	9.3
10"x10"	41 8" Max.	6.6
12"x12"	30	26.3
12"x12"	35	19.3
12"x12"	40	14.8
12"x12"	45	11.7
12"x12"	50 Max.	9.5

(7) When gin poles are spliced to increase their length, the splicing shall be made with heavy planking at least four feet long securely bolted to all four (4) sides of the pole. If splicing planks are spiked, they shall be securely lashed at the same points.

(8) Additional guy lines shall be attached at the point of splice.

[Order 74-26, § 296-155-555, filed 5/7/74, effective 6/6/74.]

WAC 296-155-560 Concrete bucket towers.

(1) A concrete bucket tower located inside a structure, and which is three feet or less from any scaffold or the edge of the shaftway or floor opening in which it is installed, shall be enclosed on all sides with heavy wire netting formed of number sixteen U.S. gauge one and one-half inch mesh. Wood slats placed vertically and spaced not more than one and one-half inches apart may be used instead of the netting.

WAC 296-155-560 (Cont.)

The enclosure shall extend at least eight feet above such scaffold or floor.

(2) A concrete bucket tower located outside a structure shall be enclosed to a height of eight feet at lower landing with heavy wire netting formed of number sixteen U.S. gauge wire one and one-half inch mesh or other suitable material.

(3) Openings with platforms shall be formed at each floor level, and the runway leading to the tower shall be guarded with standard railings and toeboards.

(4) If the bucket is discharged into a chute, the chute shall be substantially constructed of wood or metal and extend from the tower to the point where the concrete is to be poured, or transferred to vehicles or hoppers, and the chute shall be substantially supported.

(5) The pit shall be drained and deep enough so that any spill from the bucket will fall below the blocking on which the bucket rests while being filled.

(6) Persons shall not be allowed to work in the pit without first resting the bucket on strong timbers supported on two sides of the tower.

(7) The bucket tower shall be securely guyed at two or more elevations as may be necessary.

(8) The guide rails shall be carefully aligned and kept in good condition to prevent the bucket being caught or clogged while being hoisted.

(9) The sheaves over which the cable passes shall be firmly secured to overhead sheave beams and supporting frame work and the sheaves shall be kept lubricated.

(10) The hoisting cable shall be frequently inspected and renewed when broken wires or other defects are discovered.

(11) A platform provided with standard railings and toeboards shall be constructed at the point where the concrete is dumped into the chute. A ladder shall be fastened to one side of the tower to enable a person to reach the platform in safety.

(12) Workers shall be prohibited from riding in or on the bucket.

[Order 74-26, § 296-l55-560, filed 5/7/74, effective 6/6/74.]

WAC 296-155-565 Hoisting engines.

(1) All gearing on hoisting engines shall be enclosed. Steam piping subject to contact shall be insulated and if electrical equipment is used, it shall be grounded.

(2) Hoisting engines shall be of ample capacity and equipped with brakes capable of sustaining one hundred and fifty percent of rated load for stopping and sustaining the maximum load in any position.

(3) Hoisting engines shall be protected against the weather and falling objects by a substantial cover.

(4) All hoisting equipment shall be frequently inspected, and brakes, gears and operating levers kept in working condition.

WAC 296-155-565 (Cont.)

(5) Guards shall be provided to prevent persons coming in contact with hoisting cables.

(6) Brake drums shall be kept free of oil or grease.

(7) A positive operated pawl shall be used in addition to the brake to hold the load when it is suspended. Counter weight operated dogs are prohibited.

(8) Hoisting engines shall not be set up in the street when it can be avoided; but, if so located, they shall be completely housed.

(9) Only competent personnel shall operate material hoists.

(10) The operator shall not lift a load when a person is on the hoist, and all towers shall be posted to that effect, except as provided in other sections of this part.

(11) The operator shall be notified when any person goes up the tower ladder, or before any work is done on any part of the tower, overhead work, hoist or in the pit.

(12) The operator shall make daily inspections of all equipment before starting operations.

(13) When the hoisting engine is located close to the building operation, it shall be covered with a strong plank roof covering to protect the operator from falling objects.

(14) Exhaust steam pipes shall discharge overhead so as not to obstruct the view of the operator or scald persons.

(15) In the operation of hoists, the operator shall always give a warning sign or signal before starting.

(16) When hoisting machinery is set on an elevated platform such platform shall be of substantial construction and standard guard rails and toeboards shall be provided along all open sides of the platform.

(17) Material hoists of more than one drum capacity shall be equipped with brake controls.

(18) A safety strap shall be provided on the foot block of all hoists.

(19) When electric motors are used for hoisting equipment, they shall be operated only by qualified personnel.

(a) Installations shall be made in accordance with provisions of local and national electrical safety codes, and shall be made by experienced workers only.

(b) Inclosed switches and fuses shall always be used.

(c) Switchboards shall be screened, and a sign placed warning unauthorized persons to keep clear.

[Statutory Authority: Chapter 49.17 RCW. 94-15-096 (Order 94-07), § 296-155-565, filed 7/20/94, effective 9/20/94; Order 74-26, § 296-155-565, filed 5/7/74, effective 6/6/74]

WAC 296-155-570 Rigging-Wire rope.

(1) Whenever used in connection with work, employment, occupations or uses to which these standards are applicable, wire rope shall not be subjected to loads in excess of one-fifth the breaking load as given in the schedule of the cable manufacturer.

WAC 296-155-570 (Cont.)

(2) Any wire rope showing 10% of its wires broken in a three foot length shall not be used. When cables deteriorate through rusting, wear, undue strain or other conditions to the extent of 15% of their original strength, use of cable shall be discontinued.

(3) Wire rope shall be frequently inspected for wear and other defects which may reduce the strength below the point of safe operation.

(4) If wire rope is received in a coil it shall be rolled out, on a surface free from grit, like a hoop and straightened out before being put on the sheaves. If it is received on a reel, the reel shall be mounted on a spindle or turntable and the rope then unwound.

(5) Wire rope shall be lubricated. A lubricant recommended by a wire rope manufacturer shall be used.

(6) Wire rope shall be securely fastened to drums by zinc plugs or suitable clamps, and at least two full turns of the rope shall remain on the winding drum.

(7) Wire rope shall be wound evenly on the drum and not allowed to lap one layer on another in an irregular fashion.

(8) Care shall be taken to prevent friction of wire ropes with other objects which could cause chafing or breaking of wires.

(9) In attaching U-type cable clamps, the U shall always be placed over the short end of the cable.

(10) The clamp nuts shall be tightened up frequently during the operation to prevent slipping.

(11) Thimbles shall be used in cable eyes whenever practicable.

(12) Fair leads shall be used ahead of cable drums, whenever practicable, and the fleet angle kept as flat as possible to promote proper spooling.

(13) All running lines of hoisting equipment, located within seven (7) feet of the ground or working level shall be boxed, railed off or otherwise guarded, or the operating area restricted.

(14) Wire rope which has been welded or been subject to welding of any kind shall not be used.

(15) No open hook shall be used to hoist a bucket, cage, spreader, or skip, nor in any circumstances where the dislodgement of the hook could cause a risk of injury to workers. A safety-hook, mousing, or shackle shall be employed in such circumstances.

(16) When shackles are used, shackle pins shall be secured to prevent accidental withdrawal.

(17) Where a wedge socket connector is used as a wire rope terminal, a single wire rope clip shall be installed in accordance with WAC 296-155-330 (3)(g).

(18) The wire rope shall not be burned off with heat. This may weld the ends of the wires and strands together.

[Statutory Authority: RCW 49.17.040 and 49.17.050. 86-03-074 (Order 86-14), § 296-155-570, filed 1/21/86; Order 74-26, § 296-155-570, filed 5/7/74, effective 6/6/74.]

WAC 296-155-59901 Table 1.

TABLE 1
STANDARD 6 x 7 WIRE ROPE[1]

		Breaking Strength in Tons of 2,000 Pounds		
DIAMETER **Inches**	**Approximate Weight Per Foot** **Pounds**	**Improved Plow Steel**	**Plow Steel**	**Mild Plow Steel**
1/4	0.094	2.64	2.30	3.10
5/16	.15	4.10	3.56	3.10
3/8	.21	5.86	5.10	4.43
7/17	.29	7.93	6.90	6.00
1/2	.38	10.3	8.96	7.79
9/16	.48	13.0	11.3	9.82
5/8	.59	15.9	13.9	12.0
3/4	.84	22.7	19.8	17.2
7/8	1.15	30.7	26.7	23.2
1	1.50	39.7	34.5	30.0
1 1/8	1.90	49.8	43.3	37.7
1 1/4	2.34	61.0	53.0	46.1
1 3/8	2.84	73.1	63.6	55.3
1 1/2	3.38	86.2	75.0	65.

[1] For these ropes with steel centers, add 7 1/2% to the above strengths. For these ropes when galvanized, deduct 10% from the above strengths.

[Order 74-26, § 296-155-580 (part), Table 1 (codified as WAC 296-155-59901), filed 5/7/74, effective 6/6/74.]

WAC 296-155-59902 Table 2.

TABLE 2
STANDARD 6 x 19 WIRE ROPE[1]

DIAMETER Inches	Approximate Weight Per Foot Pounds	Breaking Strength in Tons of 2,000 Pounds		
		Improved Plow Steel	Plow Steel	Mild Plow Steel
1/4	0.10	2.74	2.39	2.07
5/16	.16	4.26	3.71	3.22
3/8	.23	6.10	5.31	4.62
7/16	.31	8.27	7.19	6.25
1/2	.40	10.7	9.35	8.13
9/16	.51	13.5	11.8	10.2
5/8	.63	16.7	14.5	12.6
3/4	.90	23.8	20.7	18.0
7/8	1.23	32.2	28.0	24.3
1	1.60	41.8	36.4	31.6
1 1/8	2.03	52.6	45.7	39.8
1 1/4	2.50	64.6	56.2	48.8
1 3/8	3.03	77.7	67.5	58.8
1 1/2	3.60	92.0	80.0	69.6
1 5/8	4.23	107.0	93.4	81.2
1 3/4	4.90	124.0	108.0	93.6
1 7/8	5.63	141.0	123.0	107.0
2	6.40	160.0	139.0	121.0
2 1/8	7.23	179.0	156.0	---
2 1/4	8.10	200.0	174.0	---
2 1/2	10.0	244.0	212.0	---
2 3/4	12.10	292.0	254.0	---

[1] For these ropes with steel centers, add 7 1/2% to the above strengths. For these ropes when galvanized, deduct 10% from the above strengths.

[Order 74-26, § 296-155-580 (part), Table 2 (codified as WAC 296-155-59902), filed 5/7/74, effective 6/6/74.]

WAC 296-155-59903 Table 3.

TABLE 3
STANDARD 8 x 19 WIRE ROPE[1]

		Breaking Strength in Tons of 2,000 Pounds	
DIAMETER Inches	**Approximate Weight per Foot Pounds**	**Improved Plow Steel**	**Mild Plow Steel**
1/4	0.09	2.35	2.04
5/16	.14	3.65	3.18
3/8	.20	5.24	4.55
7/16	.28	7.09	6.17
1/2	.36	9.23	8.02
9/16	.46	11.6	10.1
5/8	.57	14.3	12.4
3/4	.82	20.5	17.8
7/8	1.11	27.7	24.1
1	1.45	36.0	31.3
1 1/8	1.84	45.3	39.4
1 1/4	2.27	55.7	48.4
1 3/8	2.74	67.1	58.3
1 1/2	3.26	79.4	69.1

1 For these ropes with steel centers, add 7 1/2% to the above strengths. For these ropes when galvanized, deduct 10% from the above strengths.

[Order 74-26, § 296-155-580 (part), Table 3 (codified as WAC 296-155-59903), filed 5/7/74, effective 6/6/74.]

WAC 296-155-59904 Table 4.

TABLE 4 STANDARD 6 X 37 WIRE ROPE[1]			
		Breaking Strength in Tons of 2,000 Pounds	
DIAMETER Inches	Approximate Weight per Foot Pounds	Improved Plow Steel	Mild Plow Steel
1/4	0.10	2.59	2.25
5/16	.16	4.03	3.50
3/8	.22	5.77	5.02
7/16	.30	7.82	6.80
1/2	.39	10.2	8.85
9/16	.49	12.9	11.2
5/8	.61	15.8	13.7
3/4	.87	22.6	19.6
7/8	1.19	30.6	26.6
1	1.55	39.8	34.6
1 1/8	1.96	50.1	43.5
1 1/4	2.42	61.5	53.5
1 3/8	2.93	74.1	64.5
1 1/2	3.49	87.9	76.4
1 5/8	4.09	103.0	89.3
1 3/4	4.75	119.0	103.0
1 7/8	5.45	136.0	118.0
2	6.20	154.0	134.0
2 1/8	7.00	173.0	150.0
2 1/4	7.85	193.0	168.0
2 1/2	9.69	236.0	205.0
2 3/4	11.72	284.0	247.0
3	13.95	335.0	291.0
3 1/4	16.37	390.0	339.0
3 1/2	19.40	449.0	390.0

[1] For these ropes with steel centers, add 7 1/2% to the above strengths. For these ropes when galvanized, deduct 10% from the above strengths.

[Statutory Authority: Chapter 49.17 RCW. 91-24-017 (Order 91-07), § 296-155-59904, filed 11/22/91, effective 12/24/91; Order 74-26, § 296-155-580 (part), Table 4 (codified as WAC 296-155-59904), filed 5/7/74, effective 6/6/74.]

WAC 296-155-59905 Table 5.

TABLE 5
STANDARD 6 x 19 ELEVATOR ROPE

		Breaking Strength		
DIAMETER **Inches**	**Approximate Weight Per Foot** **Pounds**	**Iron** **Pounds**	**Traction Steel** **Pounds**	**High Rise Traction Steel** **Pounds**
3/16	0.06	1,300	---	---
1/4	.10	2,200	3,600	---
5/16	.16	3,200	5,600	---
3/8	.23	5,000	8,200	---
7/16	.31	6,400	11,000	---
1/2	.40	8,400	14,500	---
9/16	.51	10,600	18,500	---
5/8	.63	12,800	23,000	---
11/16	.76	---	27,000	30,000
3/4	.90	18,200	32,000	---
13/16	1.06	---	37,000	46,000
7/8	1.23	24,800	42,000	---
15/16	1.41	---	48,000	60,000
1	1.60	32,000	54,000	---
1/16	1.81	---	61,000	---

[Order 74-26, § 296-155-580 (part), Table 5 (codified as WAC 296-155-59905), filed 5/7/74, effective 6/6/74.]

WAC 296-155-59906 Table 6.

TABLE 6
STANDARD 8 x 19 ELEVATOR ROPE

		Breaking Strength		
DIAMETER **Inches**	**Approximate Weight Per Foot** **Pounds**	**Iron** **Pounds**	**Traction Steel** **Pounds**	**High Rise Traction Steel** **Pounds**
3/16	0.05	1,000	---	---
1/4	.09	1,800	3,600	---
5/16	.14	2,900	5,600	---
3/8	.20	4,200	8,200	---
7/16	.28	5,600	11,000	---
1/2	.36	7,200	14,500	---
9/16	.46	9,200	18,500	---
5/8	.57	11,200	23,000	---
11/16	.69	---	27,000	30,000
3/4	.82	16,000	32,000	---
13/16	.96	---	37,000	46,000
7/8	1.11	21,400	42,000	---
15/16	1.27	---	48,000	60,000
1	1.45	28,000	54,000	---
1 1/16	1.64	---	61,000	---

[Order 74-26, § 296-155-580 (part), Table 6 (codified as WAC 296-155-59906), filed 5/7/74, effective 6/6/74.]

WAC 296-155-59907 Table 7.

TABLE 7 STANDARD 5 x 19 MARLINE CLAD ROPE[1]				
DIAMETER			Breaking Strength in Tons of 2,000 Pounds	
Before Serving Inches	After Serving Inches	Approximate Weight Per Foot Pounds	Plow Steel	Mild Plow Steel
1/4	9/16	0.21	2.17	1.89
5/16	5/8	.28	3.37	2.93
3/8	11/16	.36	4.82	4.20
7/16	3/4	.42	6.53	5.68
1/2	13/16	.51	8.50	7.39
9/16	7/8	.62	10.7	9.31
5/8	1	.81	13.2	11.4
3/4	1 1/8	1.10	18.8	16.4
7/8	1 1/4	1.70	25.5	22.1
1	1 3/8	1.32	33.7	28.7
1 1/8	1 1/2	2.12	41.6	36.2
1 1/4	1 5/8	2.58	51.1	44.4
1 3/8	1 3/4	3.14	61.4	53.4
1 1/2	1 7/8	3.69	---	---
1 5/8	2	4.29	---	---
1 3/4	2 1/8	5.00	---	---

[1] For these ropes with steel centers, add 7 1/2% to the above strengths. For these ropes when galvanized, deduct 10% from the above strengths.

[Order 74-26, § 296-155-580 (part), Table 7 (codified as WAC 296-155-59907), filed 5/7/74, effective 6/6/74.]

WAC 296-155-59908 Table 8.

TABLE 8 STANDARD 18 x 7 NONROTATING ROPE			
		Breaking Strength in Tons of 2,000 Pounds	
DIAMETER Inches	Approximate Weight per Foot Pounds	Improved Plow Steel	Mild Plow Steel
3/8	0.24	5.59	4.86
7/16	.33	7.58	6.59
1/2	.43	9.85	8.57
9/16	.55	12.4	10.8
5/8	.68	15.3	13.3
3/4	.97	21.8	19.0
7/8	1.32	29.5	25.7
1	1.73	38.3	33.3
1 1/8	2.19	48.2	41.9
1 1/4	2.70	59.2	51.5
1 3/8	3.27	71.3	62.0
1 1/2	3.89	84.4	73.4
1 5/8	4.57	98.4	85.6
1 3/4	5.30	114.0	98.8

[Order 74-26, § 296-155-580 (part), Table 8 (codified as WAC 296-155-59908), filed 5/7/74, effective 6/6/74.]

WAC 296-155-59909 Table 9.

TABLE 9 STANDARD 6 x 12 GALVANIZED RUNNING ROPE AND HAWSERS				
		Breaking Strength in Tons of 2,000 Pounds		
DIAMETER Inches	Approximate Weight Per Foot Pounds	Galvanized Improved Plow Steel	Galvanized Plow Steel	Galvanized Iron
5/16	0.10	2.34	2.04	0.905
3/8	.15	3.36	2.92	1.30
7/16	.20	4.55	3.95	1.76
1/2	.26	5.91	5.14	2.28
9/16	.33	7.45	6.48	2.88
5/8	.41	9.16	7.97	3.54
3/4	.59	13.1	11.4	5.06
13/16	.6	15.3	13.3	5.92
7/8	.80	17.7	15.4	6.85
1	1.05	23.0	20.0	8.89
1 1/16	1.19	25.9	22.5	10.0
1 1/8	1.33	29.0	25.2	---
1 3/16	1.48	32.2	28.0	---
1 1/4	1.64	35.6	30.9	---
1 3/8	1.99	42.8	37.2	---
1 7/16	2.17	46.7	40.6	---
1 1/2	2.36	50.7	44.1	---
1 5/8	2.77	59.2	51.4	---
1 11/16	2.99	63.6	55.3	---
1 3/4	3.22	68.3	59.4	---
1 13/16	3.45	78.0	63.5	---
1 15/16	3.94	83.0	72.2	---
2	4.20	88.2	76.7	---
2 1/16	4.47	93.6	81.4	---

[Order 74-26, § 296-155-580 (part), Table 9 (codified as WAC 296-155-59909), filed 5/7/74, effective 6/6/74.]

WAC 296-155-59910 Table 10.

TABLE 10 STANDARD 6 x 25 GALVANIZED STEEL MOORING LINES AND HAWSERS			
		Breaking Strength in Tons of 2,000 Pounds	
DIAMETER Inches	Approximate Weight per Foot Pounds	Galvanized Improved Plow Steel	Galvanized Plow Steel
3/8	0.194	4.77	4.14
1/2	.35	8.40	7.30
5/8	.54	13.0	7.30
3/4	.78	18.6	16.2
13/16	.91	21.8	19.0
7/8	1.06	25.2	21.9
1	1.38	32.8	28.5
1 1/16	1.56	36.9	32.1
1 1/8	1.75	41.2	35.9
1 3/16	1.95	45.9	39.9
1 1/4	2.16	50.7	44.1
1 3/8	2.61	61.0	53.0
1 7/16	2.85	66.5	57.9
1 1/2	3.11	72.3	62.9
1 5/8	3.64	84.5	73.4
1 11/16	3.93	90.9	79.0
1 3/4	4.23	97.5	84.8
1 13/16	4.53	104.0	90.0
1 15/16	5.18	119.0	103.0
2	5.52	126.0	110.0
2 1/16	5.87	134.0	116.0

[Order 74-26, § 296-155-580 (part), Table 10 (codified as WAC 296-155-59910), filed 5/7/74, effective 6/6/74.]

WAC 296-155-59911 Table 11.

TABLE 11 STANDARD 6 x 37 GALVANIZED STEEL HAWSERS			
		Breaking Strength in Tons of 2,000 Pounds	
DIAMETER Inches	Approximate Weight per Foot Pounds	Improved Plow Steel	Plow Steel
3/4	0.87	21.0	18.2
13/16	1.02	24.5	21.2
7/8	0.87	21.0	24.7
1	1.55	36.9	32.1
1 1/16	1.75	41.6	36.1
1 1/8	1.96	46.5	40.4
1 3/16	2.19	51.7	44.9
1 1/4	2.42	57.1	49.7
1 3/8	2.93	68.8	59.8
1 7/16	3.20	75.0	65.3
1 1/2	3.49	81.5	70.9
1 5/8	4.09	95.3	82.9
1 11/16	4.41	103.0	89.2
1 3/4	4.75	110.0	95.7
1 13/16	5.09	118.0	102.0
1 15/16	5.82	134.0	117.0
2	6.20	143.0	124.0
2 1/16	6.59	151.0	132.0
2 1.8	7.00	160.0	139.0
2 1/4	7.85	179.0	156.0
2 5/16	8.29	189.0	164.0
2 3/8	8.74	199.0	173.0

[Order 74-26, § 296-155-580 (part), Table 11 (codified as WAC 296-155-59911), filed 5/7/74, effective 6/6/74.]

WAC 296-155-59912. Table 12.

TABLE 12 STANDARD 6 x 25 TYPE "B" FLATTENED STRAND WIRE ROPE[1]			
		Breaking Strength in Tons of 2,000 Pounds	
DIAMETER Inches	Approximate Weight per Foot Pounds	Improved Plow Steel	Plow Steel
3/8	0.25	6.71	---
1/2	.45	11.8	8.94
9/16	.57	14.9	11.2
5/8	.70	18.3	13.9
3/4	1.01	26.2	19.8
7/8	1.39	35.4	26.8
1	1.80	46.0	34.8
1 1/8	2.28	57.9	43.8
1 1/4	2.81	71.0	53.7
1 3/8	3.40	85.5	---
1 1/2	4.05	101.0	---
1 5/8	4.75	118.0	---
1 3/4	5.51	136.0	---
2	7.20	176.0	---
2 1/4	9.10	220.0	---
2 1/2	11.20	269.0	---
2 3/4	13.60	321.0	---

[1] For these ropes when galvanized, deduct 10 percent form the above strengths.

[Order 74-26, § 296-155-580 (part), Table 12 (codified as WAC 296-155-59912), filed 5/7/74, effective 6/6/74.]

WAC 296-155-59913 Table 13.

TABLE 13 STANDARD 6 x 30 TYPE "G" FLATTENED STRAND WIRE ROPE[1]			
		Breaking Strength in Tons of 2,000 Pounds	
DIAMETER Inches	Approximate Weight per Foot Pounds	Improved Plow Steel	Plow Steel
5/8	0.70	18.3	13.9
3/4	1.01	26.2	19.8
7/8	1.39	35.4	26.8
1	1.80	46.0	34.8
1 1/8	2.28	57.9	43.8
1 1/4	2.81	71.0	53.7
1 3/8	3.40	85.5	---
1 1/2	4.05	101.0	---
1 5/8	4.75	118.0	---
1 3/4	5.51	136.0	---
2	7.20	176.0	---
2 1/4	9.10	220.0	---
2 1/2	11.20	269.0	---
2 3/4	13.60	321.0	---

[1] For these ropes with steel centers, add 7 1/2% to above strengths.

[Order 74-26, § 296-155-580 (part), Table 13 (codified as WAC 296-155-59913), filed 5/7/74, effective 6/6/74.]

WAC 296-155-59914 Table 14.

TABLE 14 STANDARD 6 x 8 TYPE "D" FLATTENED STRAND WIRE ROPE			
DIAMETER	Approximate Weight per Foot	Breaking Strength in Tons of 2,000 Pounds	
		Improved Plow Steel	Plow Steel
Inches	Pounds		
1/2	0.45	11.1	8.37
5/8	.70	17.1	12.9
3/4	1.01	24.4	18.5
7/8	1.39	33.0	24.9
1	1.80	42.7	32.3
1 1/8	2.28	53.5	40.5
1 1/4	2.81	65.5	49.5
1 3/8	3.40	78.6	59.4
1 1/2	4.05	92.7	70.1

[Order 74-26, § 296-155-580 (part), Table 14 (codified as WAC 296-155-59914), filed 5/7/74, effective 6/6/74.]

WAC 296-155-59915 Table 15.

TABLE 15 STANDARD 6 x 6 x 7 TILLER ROPE[1]			
DIAMETER	Approximate Weight per Foot	Breaking Strength in Tons of 2,000 Pounds	
		Plow Steel	Iron
Inches	Pounds		
1/4	0.07	1.31	0.584
5/16	.11	2.05	.908
3/8	.16	2.93	1.30
7/16	.21	3.98	1.77
1/2	.28	5.18	2.30
9/16	.35	6.53	2.90
5/8	.43	8.04	3.57

[1] For these ropes with steel centers, add 7-1/2% to above strengths.

[Order 74-26, § 296-155-580 (part), Table 15 (codified as WAC 296-155-59915), filed 5/7/74, effective 6/6/74.]

WAC 296-155-59916 Table 16.

TABLE 16 STANDARD 9 x 4 GALVANIZED MAST ARM ROPE		
Diameter (Inches)	**Approximate Weight per Foot (Pounds)**	**Breaking Strength in Pounds**
¼	0.070	1,100
5/16	.107	1,530
3/8	.158	2,200

[Order 74-26, § 296-155-580 (part), Table 16 (codified as WAC 296-155-59916), filed 5/7/74, effective 6/6/74.]

WAC 296-155-59917 Table 17.

TABLE 17 STANDARD FLAT ROPE				
			Breaking Strength in Tons of 2,000 Pounds	
Width and Thickness Inches	Number Of Ropes	Approximate Weight per Foot Pounds	Plow Steel	Mild Plow Steel
1/4 x 1-1/2	7	0.69	16.8	14.6
1/4 x 2	9	.88	21.7	18.8
1/4 x 2-1/2	11	1.15	26.5	23.0
1/4 x 3	13	1.34	31.3	27.2
5/16 x 1-1/2	5	.77	18.5	16.0
5/16 x 2	7	1.05	25.8	22.4
5/16 x 2-1/2	9	1.33	33.2	28.8
5/16 x 3	11	1.61	40.5	35.3
5/16 x 3-1/2	13	1.89	47.9	41.7
5/16 x 4	15	2.17	55.3	48.1
3/8 x 2	6	1.25	31.4	27.3
3/8 x 2-1/2	8	1.64	41.8	36.4
3/8 x 3	9	1.84	47.1	40.9
3/8 x 3-1/2	11	2.23	57.5	50.0
3/8 x 4	12	2.44	62.7	54.6
3/8 x 4-1/2	14	2.83	73.2	63.7
3/8 x 5	15	3.03	78.4	68.2
3/8 x 5-1/2	17	3.42	88.9	77.3
3/8 x 6	18	3.63	94.1	81.9
1/2 x 2-1/2	6	2.13	54.5	47.4
1/2 x 3	7	2.47	63.6	55.4
1/2 x 3-1/2	8	2.82	72.7	63.3
1/2 x 4	9	3.16	81.8	71.2
1/2 x 4-1/2	10	3.82	90.9	79.1
1/2 x 5	12	4.16	109.0	94.9
1/2 x 5-1/2	13	4.50	118.0	103.0
1/2 x 6	14	4.85	127.0	111.0
1/2 x 7	16	5.85	145.0	126.0
5/8 x 3-1/2	6	3.40	85.8	74.6
5/8 x 4	7	3.95	100.0	87.1
5/8 x 4-1/2	8	4.50	114.0	99.5
5/8 x 5	9	5.04	129.0	112.0
5/8 x 5-1/2	10	5.59	143.0	124.0
5/8 x 6	11	6.14	157.0	137.0
5/8 x 7	13	7.23	186.0	162.0
5/8 x 8	15	8.32	214.0	186.0
3/4 x 5	8	6.50	165.0	143.0
3/4 x 6	9	7.31	185.0	161.0
3/4 x 7	10	8.13	206.0	179.0

WAC 296-155-59917 Table 17.

TABLE 17 STANDARD FLAT ROPE (Cont.)				
			Breaking Strength in Tons of 2,000 Pounds	
Width and Thickness Inches	Number Of Ropes	Approximate Weight per Foot Pounds	Plow Steel	Mild Plow Steel
3/4 x 8	11	9.70	227.0	197.0
7/8 x 5	7	7.50	190.0	165.0
7/8 x 6	8	8.56	217.0	188.0
7/8 x 7	9	9.63	244.0	212.0
7/8 x 8	10	10.69	271.0	236.0

[Order 74-26, § 296-155-580 (part), Table 17 (codified as WAC 296-155-59917), filed 5/7/74, effective 6/6/74.]

WAC 296-155-59918 Table 18.

TABLE 18 STANDARD 6 x 12 MARLINE CLAD GRAIN-SHOVEL ROPE			
Before Serving (Inches)	After Serving (Inches)	Approximate weight per Foot (Pounds)	Breaking Strength Tons of 2,000 Pounds
3/4	5/8	0.25	2.50
7/8	¾	.43	5.50

[Order 74-26, § 296-155-580 (part), Table 18 (codified as WAC 296-155-59918), filed 5/7/74, effective 6/6/74.]

WAC 296-155-59919 Table 19.

TABLE 19 STANDARD 6 x 7 IRON, BRIGHT, AND GALVANIZED SASH CORDS				
DIAMETER	Approximate Weight Per Foot	BREAKING STRENGTH Hand Drawn (Iron) Bright	Galvanized	Annealed Bright or Galvanized
Inches	Pounds	Pounds	Pounds	Pounds
1/16	0.006	140	126	77
3/32	.103	315	283	172
1/8	.023	560	504	306
5/32	.038	840	756	478
3/16	.053	1,150	1,035	688
7/32	.072	1,570	1,413	940
1/4	.094	2,040	1,836	1,225

[Order 74-26, § 296-155-580 (part), Table 19 (codified as WAC 296-155-59919), filed 5/7/74, effective 6/6/74.]

WAC 296-155-59920 Table 20.

TABLE 20 STANDARD 6 x 7 GALVANIZED IRON RIGGING AND GUY ROPE		
Diameter (Inches)	Approximate Weight Per Foot (Pounds)	Breaking Strength in Tons of 2,000 Pounds
6 Strands		
1/4	0.94	0.918
5/16	.15	1.42
3/8	.21	2.04
7/16	.29	2.76
1/2	.38	3.58
9/16	.48	4.51
5/8	.59	5.54
3/4	.84	7.90
13/16	.99	9.23
7/8	1.15	10.7
1	1.50	13.8
1 1/16	1.70	15.5
1 1/8	1.90	17.3
1 3/16	2.12	19.2
1 1/4	2.34	21.2

[Order 74-26, § 296-155-580 (part), Table 20 (codified as WAC 296-155-59920), filed 5/7/74, effective 6/6/74.]